BRIGHTON AND SUSSEX

Natural History & Philosophical Society.

ABSTRACTS OF PAPERS

READ BEFORE THE SOCIETY.

TOGETHER WITH THE

ANNUAL REPORT

FOR THE

YEAR ENDING JUNE 13TH, 1888.

Brighton:

THE SOUTHERN PUBLISHING COMPANY, LIMITED,

130, NORTH STREET, TELEPHONE No. 52.—(8668).

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INAUGURAL ADDRESS.

OCTOBER 13th, 1887.

Mr. SEYMOUR BURROWS, B.A. (Cantab), M.R.C.S.

Mr. Burrows commenced by remarking on the nobility of the study of Nature, and of the manifold and attractive aspects under which She is presented to our eyes. In the process of years the varied and accumulated results of many observers required that some classification should be given to the subjects of their study. Among the great classifiers might be named Aristotle, Pliny, Athenœus, Albertus Magnus, Gesner, Ray, Buffon, Linnæus, Cuvier, and Owen. So vast is the field which the study of Nature presents, that to-day, at any rate in its entirety, it is too wide for any one mind to embrace. But though all but the most gifted minds must content themselves with a little knowledge of her works. yet this, instead of being a dangerous thing, may be of the greatest use to us. To cultivate a habit of observation even within narrow limits, and to take an interest in the things which surround us, is itself an education. Mr. Burrows then alluded to Museums, and to the part which they ought to play in this education. He remarked on the better organization and adaptation to the wants and requirements of students which Museums abroad presented compared with those of our own country. They were open at times also most convenient for artizans and the working classes generally to attend ; and he thought in this respect we might with advantage follow the example set us on the other side of the Channel. Every Museum should be a place where one could learn the main facts concerning the geology, the botany, and the zoology of the country around. Mr. Burrows then enlarged on the many opportunites for acquiring knowledge which even a dweller in

towns enjoyed, more particularly with regard to microscopical studies, and shewed how easily matter could be obtained which would give occupation and pleasure for many a delightful evening. In conclusion, Mr. Burrows made an earnest appeal to the members present and to the Society at large to second the efforts which were now being made to render their meetings more popular and more helpful to all interested in the study of Nature.

OCTOBER 19th, 1887.

SPECIAL MEETING

CALLED TO CONSIDER

REVISION OF RULES.

OCTOBER 27th, 1887.

"GLACIERS,"

Lecture, with Oxy-Hydrogen Lantern, in

BANQUETING ROOM, TOWN HALL, HOVE,

MR. PANKHURST.

NOVEMBER 16th, 1887.

EYES IN THE LOWER ANIMALS.

Mr. W. H. REAN, M.R.C.S.

The human eye, Mr. Rean said, might be conveniently taken as a standard with which to compare all other eyes. The development of the optical apparatus of other animals could be referred to it, and their various modifications as they approached or receded from this standard be more clearly described.

After having given a sketch of the principal parts of the human eye, Mr. Rean observed that at the very outset of our investigations a difficulty confronted us. What is the lowest form in which any organs presented themselves for transmitting the rays of light? There are many creatures which are either attracted or repelled by the rays of light, and yet afford no indication to the most careful examiner of any optical apparatus. It may be that the heat which accompanies the ray acts on some nerve sensitive to its action. Probably in the Rotifera and Entozoa some appreciation of light exists, though no organ has been discovered specially adapted to its reception.

In the Annelids the organ of vision undoubtedly exists as simple globular prominences in the skin. In the leech there are 10 in a semi-circle round the front of the mouth, in other worms there are four. In these there is a transparent skin which may be regarded as the simplest form of the cornea.

Among the Molluscs, the Gasteropoda shew eyes far more developed than in the Annelids.

In the common snail they are at the extremity of the so called horns. They consist of a transparent portion of skin, answering to the cornea, a tubercular extension of the optic nerve, containing a black choroid and in front a perfectly developed globular lens. Passing to the Articulata, one is overwhelmed by the delicacy and beauty of the various forms of optical apparatus. The eyes of insects may be divided into four distinct classes, firstly, The simple eye; secondly, the conglomerate, composed of many simple eyes aggregated together; thirdly, the compound, formed of numerous tubes, each tube composing a separate optical instrument, and fourthly, the apparently compound eye, but one with a single cornea covering the whole series of tubes. Some insects possess two of these varieties.

In the Crustacea, the eyes are situated on a longer or shorter pedicle, capable of movement in any direction, and may be withdrawn within a sheath if danger threatens. The eyes of

insects are marvellously adapted either to short or long vision. Compound eyes differ enormously in the number of their parts, in the ant, there are but 50, in the house-fly they number 8,000, while in the dragon-fly, some 12,000 have been counted. The eye of the Cephalopod approaches nearer to that of the Vertebrates. In the cuttle-fish the curious fact is noted that the retina is behind the choroid.

The eyes of all Vertebrates are of the same type, though with interesting modifications. That of the fish with its large socket and cushion of soft tissue, its flat cornea and close approximation of the retina to the lens shews how admirably it is adapted to the medium which surrounds it, and to the conditions under which the fish exists.

Mr. Rean then touched on many interesting facts connected with the eyes of Amphibia and Reptilia. He also called attention to the eyes of some birds, and remarked on the great difference which exists between those adapted to long vision in brilliant sunlight as the eagle's, and those of birds flying at night as the owl's.

Another wonderful instance may be observed in the eye of the mole, with all the curious modifications of structure which fit it for the abnormal conditions under which the animal lives.

NOVEMBER, 30th, 1887.

MICROSCOPICAL MEETING.

Subject "EYES."

Introduced by Mr. W. H. REAN.

DECEMBER 14th, 1887.

PESSIMISM.

Mr. J. E. HASELWOOD.

In the course of some prefatory remarks, Mr. Haselwood intimated that the work to which he had been mainly indebted for the substance of his paper was James Sully's "Pessimism."

The words "pessimism," and "optimism" have passed as common places into our ordinary language. The founder of philosophic Pessimism was Arthur Schopenhauer who was born at Dantzig in 1788.

WILL is at the bottom of his philosophy. In his own words "All willing arises from desire, that is from want, that is from suffering. Satisfaction makes an end of this : but nevertheless for every wish that is gratified there remain at least ten unfulfilled. Lasting, unfailing satisfaction, no desired object of the will can afford." No rest or happiness is possible therefore to man while thus for ever striving to reach a goal which it is impossible he ever can attain. But Schopenhauer gives to WILL a wider meaning than is found in the common acceptation of the word. He identifies it with all those forces of nature which are for ever working to maintain or produce all things that exist. These blind forces of nature, as we term them, in all their manifold activity, are guided by a definite purpose—and this also is *will.*

In man this great force of Nature in all its varied manifestations becomes self-conscious.

Von Hartmann differed from Schopenhauer in thus making the Will the primary principle. To *Will* he joins Intelligence or Idea.

Each successive step in the evolution of living beings is a victory of Intelligence over Blind Will or Force. In man, as the being in which evolution culminates, we have the final emancipation of the Reason from its bondage to the Will. That

the purpose of this world-evolution is the happiness of man, as many think, Hartmann regards as an illusion. The ancient world placed happiness in the present life of the individual, the Christian world in a future life. Hartmann not only regards these as illusions, but also that hope which looks for happiness in a future ameliorated condition of humanity. This last one, found by experience to be a deception, there will be no further illusion possible. The sum of actual pain and misery will in no wise tend to diminish, but greater evils will spring out of an advancing civilization than any benefits that it brings. An ever-increasing discontent must of necessity mark its path. It is useless for the individual to strive against the unhappiness and misery of social life, for they are irremediable. " Existence is a huge blunder," and Hartmann consequently looks forward to the extinction of all conscious life as the only panacea for the evils engendered by its existence. This conclusion is founded on three bases : 1st, Metaphysical ; 2nd, Scientific ; and 3rd, Empirical. Mr. Haselwood only examined the last, and adduced some of the criticisms which Sully and others brought to bear on a method which they considered faulty. Finally he gave his own reasons for dissenting from the conclusions of the German philosophers, and seeing that ignorance was at the bottom of much of the evil which existed in the world, looked forward confidently to a time when wider intelligence and more perfect knowledge, both in governors and the governed, would be able to abate much of the misery which surrounds human life by meliorating the conditions under which it at present exists.

JANUARY 13th, 1888.

THE MINUTE ANATOMY OF ANIMAL TISSUES.

LECTURE

With Oxy-Hydrogen Lantern, at

CENTRAL SCHOOLS, CHURCH STREET, BRIGHTON.

Mr. H. EDMONDS, B.Sc.

WEDNESDAY, FEBRUARY 15th, 1888.

TEETH—THEIR STRUCTURE IN MEN AND ANIMALS.

Mr. WALTER HARRISON, D.M.D. (Harvard).

It is a common error to speak of teeth as bones. Teeth are not bones, but are developed from the skin, in other words they are dermal appendages and must be considered in the same category as hair and nails. In looking at the arrangement of human teeth in the jaws it may be noticed that no tooth is exactly over another one, and that there are no interspaces between them. Each tooth is met by two teeth. In consequence of this the loss of a single tooth is not so severely felt. The teeth are arranged around the margins of the maxillary bones in a curve which is somewhat parabolic in form. It is generally rounded after the manner of a Norman arch. In the lower races of mankind this becomes somewhat square owing to the prominence of the canine teeth. The tendency of civilization, however, is to make this curve sharper, in fact, somewhat of a Gothic arch. Its extreme shape, occasionally seen, is a V-shaped maxilla.

Some animals develop only one set of teeth, others two.

In man the first set, milk-teeth, remain till about 7 years old. In the Ungulatæ they persist until the animal has reached adult age.

The teeth in the Mammalia are built up of three different kinds of tissue, viz., Enamel, Dentine, and Cementum. The enamel of the tooth is the hardest tissue in the body, and lowest in organic matter.

The principal substance, however of which teeth are composed is dentine. Sometimes this closely resembles bone in structure. In the Mammalia, it is permeated with tubes, which radiate from the pulp cavity, containing Tomes's Fibrils; it is by means of these that it communicates with the blood-vessels, and nerves. The

PULP in the centre is the formative organ of the dentine. The dentine of different classes of the Vertebratœ differs in its structure in several important particulars. It has been classified into three groups. (1). Hard or Uni-vascular dentine, (2). Plici-dentine, and (3), Vaso-dentine.

The third substance of which teeth are formed is named Cementum. In man and the Carnivora it is confined to the roots of the teeth. In chemical composition it is nearly allied to bone.

The Attachment of Teeth. The methods by which teeth are attached offer many points of interest. There are three distinct methods by which this is effected, 1st, Membrane, 2nd, Hinge, 3rd, Anchylosis, 4th, Socket.

In the first method the teeth are affixed to a fibrous membrane which glides over the jaw, as in the shark, which during its life has an enormous number of teeth. The pike and hake afford us examples of the attachment of the teeth to the jaw-bone by hinges. The third method (anchylosis) may be found in the python and haddock, while in man and the mammalia generally they are inserted in a socket.

The author then touched on the development of teeth in the human subject, and next pointed out how intimately the form and structure of the teeth were associated in different animals with the food and habits of life of the animal to which they belonged. The incisors for instance distinguish the Rodents, the large development of the canines the Carnivora, and a peculiar shape of the molars is characteristic of the Ruminants.

WEDNESDAY, MARCH 14th, 1888.

OBSERVATIONS IN MOTH BREEDING FOR PEDIGREE PURPOSES.

Mr. F. MERRIFIELD.

These were observations made in the course of a series of experiments tried at the instance of Mr. Francis Galton in Pedigree Moth-breeding. Mr. Merrifield said that, having obtained plenty of living specimens of *Selenia illunaria* ("Early Thorn Moth") in the spring, his experiments with that species were more advanced than with *Selenia illustraria* ("Purple Thorn Moth"). From eggs of *illunaria* laid by moths taken in the spring he had reared a second generation fed on sleeved birch trees, the moths emerging in July. From these he had made a selection of long-winged (A), medium-winged (M), and short-winged (Z) pairs, and from each of these pairs he had batches of pupæ numbering from 60 to 100, now hybernating. Besides the insects thus reared under natural conditions, he had reared some which were kept during all their stages in an artificial temperature averaging a little under 80° Fahr. In this way he had obtained five successive generations, the last of them being the sixth generation of the year, counting a generation as beginning with the egg (the moths caught in the spring reckoning as belonging to the first) being now in the egg stage. The forced second generation was distinctly larger than the same generation sleeved, and each successive forced generation, except the last, which had been brought up under difficulties as to food, and had suffered great mortality, shewed a measurable increase in size over its predecessor. From the forced second generation he had selected A, M, and Z pairs, from each of which he had reared a number of moths, but the A's and Z's in this third generation failed to produce fertile eggs, though several pairs of each were tried. The M's produced abundantly, and from one of these M pairs he bred 61 moths, from which he had again selected A's, M's and Z's, which laid fertile eggs, and from each of these pairs he had obtained about 7 or 8 moths, all proving sterile

except one pair of Z's and perhaps one pair of M's. He refrained at present from any inferences as to the cause of the sterility of the third generation of forced moths in the A and Z lines, but thought it would be prudent in these experiments to include some selections from points in the scale of size considerably short of the extremes. All the successive generations were of the summer type (*Juliaria*). In all the female was on the average sensibly larger than the male, but in the natural spring emergence the reverse was the case. *S. illunaria* was the only English double-brooded Geometer, except perhaps, *T. laricaria*, which had one of its emergences in a winter month, and he threw out the suggestion whether the relatively smaller size of the female in the first emergence might be a step towards or a remnant of apterousness, usual in the female of our winter moths. It would be interesting to breed and compare *T. laricaria*. He could not undertake any other species than *illunaria* and *illustraria*, and circumstances might interfere even with them; and as the experiments with them must continue for many generations in order to reach the results wanted for Mr. Galton's purposes, and required uninterrupted watchfulness, it was essential, to prevent an accidental failure, that there should be a second line of experiments conducted independently. Both species were very easy to rear, and offered much scope for experiment in various directions; he would gladly supply eggs in the spring for the purpose. Mr. Merrifield further said he should be glad to be afforded the opportunity of seeing and, if judged expedient, breeding from unusual varieties or types of either species, or examples from Ireland, Wales, Northern regions, such as Scotland and Scandinavia, where both species appear to be single-brooded, or from Central or Southern Europe. The resting position of the Selenias was remarkable; *illunaria*, folds its wings closely together like a butterfly, and *illustraria* holds them at an angle of 50° or 60°. He exhibited two diagrams, one shewing the measurements of the successive broods, and the other the duration of the larval and other stages in each; also a number of specimens of each brood of *illunaria*, and several of *illustraria*.

APRIL 11th, 1887.

MICROSCOPICAL MEETING.

MAY 9th, 1888.

THE ORIGIN AND DEVELOPMENT OF WRITTEN LANGUAGE.

Mr. E. A. PANKHURST.

Few perhaps of all those to whom the letters of the alphabet are so familiar, look upon them as the greatest achievement of the human intellect; that they enshrine a history more important than that of any nation, and embody the culture and civilization of ages.

When we endeavour to trace the development of the written or printed characters which we use from English to Roman, from Roman to Greek, from Greek to Phœnician, from Phœnician to Egyptian hieroglyphics, and from these to the earliest efforts of man in fashioning signs for his spoken language, there are some blank pages in the earlier record due to the ravages of time. These must be supplied from the known efforts of savage, or semi-savage tribes, still in existence, to translate their thoughts into characters. Among the North American Indians, when they were first brought into contact with Europeans a method of picture-writing prevailed of which many ingenious specimens are preserved; rude pictures representing men as warriors, the signs of the tribes to which they belonged, and the places near which they fought. But even in these a picture of the sun not only stands for the sun, but for a day. The figure of the heart stands for "desire" and so on. Some progress has evidently been made. For between the mere representation of things to that of moral qualities the chasm is immense and must have taken centuries to bridge over. In the earlier Chinese characters the figure of an ear at a door stands for

hearing, a bee for *industry*, a woman and her son for the verb *to love.* It is the same in all early attempts at language. In Mexican, a man sitting on the ground represents *an earthquake.* We have thus arrived at a symbolical language. It plays an important part in Egyptian hieroglyphics, where a man holding a stick signifies *force*, two legs, *motion*, &c.

From the expression of abstract thoughts the next great step was to the expression of sounds—phonograms. Thus, the name of lapis lazuli, being pronounced in Egyptian, is khersteb; and khersf being the verb "to stop," and "teb" a pig, a man holding a pig by the tail was a phonetic representation of the word *khersteb.* In the process of the analysis of sound it was next discovered that all words might be compounded of a certain number of syllables, and certain signs of things were taken to represent syllables. Several languages never passed beyond this stage. It was reserved for the Egyptians as far as we are able to judge to take the next great step, to phonetism; that is, to adopt signs to represent only sounds. Let us see how they accomplished this step. An eagle was called *ahom*—the sound A being dominant, the figure of an eagle was made to stand for A. The mouth being called *ro* the figure of a mouth came to represent the sound *R.* Similarly a lion stood for *L*, and an owl for *M.* In all languages of comparatively uncivilized peoples the consonants are dominant, and the vowels with the exception of *a* only play an important part, later.

The Egyptians had three forms of written language, the hieroglyphics mainly sculptured on stone, the hieratic used by the priests on papyrus, and the cursive used generally for writing. The figures of the animals mentioned could not be drawn in rapid writing, and modifications of them were consequently adopted.

Strange as it may seem, the papyri unearthed from Egyptian tombs enable us to trace how our A has sprung from the figure of an eagle, our M from that of an owl, and our Y from that of the horned viper of Egypt.

From the Egyptian were derived Phœnician and Hebrew, and from these Greek and Roman and the other characters of European languages, in more or less direct descent.

Philologists generally are agreed that four or five great systems of writing have been independently invented, viz., Egyptian, Cuneiform (Babylon and Assyria), Chinese, Mexican, and perhaps the Hittite.

A large number of diagrams were used in illustration of the several steps in the Evolution of language here indicated.

ANNUAL GENERAL MEETING

JUNE 13th, 1888.

REV. H. G. DAY, M.A., Vice-President, in the Chair.

The **CHAIRMAN** having explained the objects of the Meeting, called on Mr. **PANKHURST** (Hon. Sec.) to read the

REPORT OF THE COUNCIL

FOR THE YEAR, 1887-88.

There is only one event of any special importance, which has occurred during the past year, in connection with the work of the Society, which seems to demand particular notice. We allude to the revision of the Rules.

At a Special Meeting, on the 19th October last, called for the purpose of considering a report on the subject drawn up by a Committee consisting of Mr. F. Merrifield, Dr. Ewart, Mr. J. E. Haselwood, and your two Hon. Secs., considerable changes, were made in the Rules and Regulations. Some of these which bear on the constitution of the Council will come into operation for the first time this evening.

By Rule 18 the two senior members of the old Committee will retire, and are not eligible for re-election until next year. These are Mr. C. F. Dennet and Mr. F. E. Sawyer, and the names of two other gentlemen will be submitted to you in their place. The Council however cannot part even temporarily with

such old members of the governing body of the Society without expressing their sense of the valuable services they have rendered, and the active interest they have for so many years taken in its welfare and its proceedings.

By Rule 20, the Council has to nominate not more than nine nor less than three of the past Presidents of the Society to be Vice-Presidents during the coming year. The names of these gentlemen will in due course be submitted to you. Rules 6 and 10 permit ladies to become members without entrance fee. The number is small at present of those who have availed themselves of this privilege, but it is to be hoped that members will make these new provisions more widely known, and that in consequence a larger number of ladies will appear in the list of members next year.

Since the last Report was issued, the Society has had to regret the loss by death of two of its past Presidents, viz., Mr. W. M. Hollis, J.P., and the Hon. Howe Browne. The former was for 33 years a member of the Society, and, as long as he was capable of attending its meeetings, one of our most active and efficient members.

During the past year the papers read before the Society, and the Lectures given at its meetings, have been as follows :—1887 : October 12th, Inaugural Address by the President, Mr. Seymour Burrows, B.A., M.R.C.S. ; October 27th, Lecture at Hove by Mr. Pankhurst on " Glaciers " ; November 16th " Eyes in the Lower Animals," Mr. W. H. Rean ; November 30th, Microscopical Meeting, subject " Eyes " ; December 14th, " Pessimism," Mr. J. E. Haselwood. 1888 : January 13th, Lecture at Central Schools, Church Street, by Mr. H. Edmonds, B.Sc., on " The Minute Anatomy of Animal Tissues " ; February 15th, " Teeth—their Structure in Men and Animals," Mr. Walter Harrison, D.M.D. ; March 14th, " Observations in Moth Breeding for Pedigree purposes," Mr. F. Merrifield ; April 11th, Microscopical Meeting ; May 9th, " The Origin and Development of Written Language," Mr. Pankhurst.

The Annual Excursion took place on July 5th, when about 30 members visited Chanctonbury Ring and returned to Worthing to dinner.

The field excursions have been as follows :—

1887. June 11. Falmer and Lewes.
,, July 16. Uckfield.
,, August 13. Seaford.
,, September 17. Crowborough.
,, October 15. Haywards Heath and Cuckfield.
1888. May 12. Clapham Wood.

The Council now begs to submit to you the Reports of the Treasurer and Librarian which they hope will be found satisfactory, and afterwards the names of those who have been nominated as the Council and Officers of the Society for the ensuing year.

After the Reports had been read, it was moved by MR. C. A. WELLS, seconded by MR. MARSHALL LEIGH, and resolved—

"That the Reports now brought in be received, adopted, entered on the minutes, and printed for circulation as usual."

It was moved by Mr. C. F. DENNET, seconded by Mr. BARCLAY PHILLIPS, and resolved—

"That the Treasurer's account be submitted to the Auditors, examined by the Council and printed with the report."

It was moved by MR. G. DE PARIS, seconded by Mr. C. A. WELLS and resolved—

"That the following gentlemen be officers of the Society for the ensuing year :—*President:* Mr. J. E. Haselwood; *Council:* Mr. F. Merrifield, Mr. J. Dennant, Mr. G. D. Sawyer, F.R.M.S., Dr. L. C. Badcock, Mr. Thomas Glaisyer, Mr. E. J. Petitfourt, B.A., Mr. E. J. Hart, M.R.C.S., Surgeon General J. J. Clarke, M.D., Rev. H. G. Day, M.A., Dr. W. Ainslie Hollis, F.R.C.P., Dr. J. Ewart, F.R.C.P., Mr. Seymour Burrows, B.A., M.RC.S., Mr. E. S. Medcalf, M.R.C.S., Surgeon General Dr. Edw. McKellar, Mr. W. H. Rean, M.R.C.S.; *Honorary Treasurer:* Mr. Thomas Glaisyer, 12, North Street; *Honorary Librarian:* Mr. D. E. Caush; *Honorary Curator:* Mr. Benjamin Lomax, F.L.S.; *Honorary Secretaries:* Mr. Edwd. Alloway Pankhurst, 12, Clifton Road, Mr. Jno. Colbatch Clark, 64, Middle Street."

DR. O. R. PRANKARD moved, Mr. BARCLAY PHILLIPS seconded, and it was resolved--

"That the sincere thanks of the Society be given to the Vice-Presidents, Treasurer, Committee, Hon. Librarian, Hon. Curator, and Hon. Secretaries, for their services during the past year."

MR. E. J. PETITFOURT moved, MR. HASELWOOD seconded, and it was resolved—

"That the best thanks of the Society be given to Mr. Seymour Burrows, now retiring from the office of President, for his attention to the interests of the Society during the past year."

The meeting was then resolved into an Ordinary Meeting, when Mr. Crane described the Icthyosaurus lately presented to the Museum, and Miss Crane exhibited and made remarks on some heads in baked clay from Mexico, &c. Mr. Lomax exhibited some anomalous rose buds with the petals all green.

APPENDIX I.

BRIGHTON AND SUSSEX NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.

Treasurer's Account for the year ending 13th June, 1888.

Dr.	£	s.	d.
To Balance in the hands of Treasurer, June, 1887	115	12	5
,, Annual Subscriptions and Arrears, to 1st October, 1887	33	13	0
,, Annual Subscriptions to 1st October, 1888 ...	46	10	0
,, Entrance Fees	4	10	0
	£200	5	5
Balance brought over, in the hands of Treasurer	129	0	5

Cr.	£	s.	d.
By Books and Periodicals	12	5	1
,, Printing and Stationery	26	6	6
,, Postages	9	7	0
,, Subscriptions to Societies	4	7	1
,, Commission to Collector for Subscriptions ...	3	5	5
,, Assistant Secretary's Salary	2	2	0
,, Gratuities to Assistants at Museum	3	0	0
,, Expense of Annual Excursion		16	6
,, Hire of Room, Oxy-Hydrogen Lantern, and other incidental Expenses of Meetings ...	3	11	0
,, Cost of Tea and Coffee at Meetings	2	1	10
,, Bag for Papers	1	11	6
,, Railway Fare and Cab Hire, &c.		9	6
,, Fire Insurance		12	0
,, Book Binding		14	2
,, Sundry small payments		15	5
,, Balance in hands of Treasurer, 13th June, 1888	129	0	5
	£200	5	5

Examined with books and vouchers,

F. G. CLARK,
J. E. HASELWOOD.
Auditors.

21*st June*, 1888.

LIBRARIAN'S REPORT.

During the year 1887-8, there has been an increase in the number of books sent out to the members, also in those used by the general public. The numbers are as follows :—To members, 143 ; to readers at the Free Library, 534. There have been purchased during the year the following books and periodicals :

Manual of Bacteriology, Dental Anatomy, Larvæ of Brit : Butterflies and Moths (Ray Society), Physiology of Plants, British Oribatidæ (Ray Society), The Rotifera, Sowerby's Index of British Shells.

Of the International Scientific Series the following have been purchased :

Foods, Religion and Science, The Conservation of Energy, The Brain, Money, Language, Descent and Darwinism, The Theory of Sound, The Five Senses of Man.

The periodicals subscribed to have been as follows :

Grevillea, Entomologist's Monthly Magazine, Entomologist, Zoologist's Magazine, Science Gossip, Microscopical Magazine, Nature, Studies in Microscopical Science.

Several pamphlets have been presented to the Library and Reports of various Scientific Societies.

The new catalogue mentioned in the last report has been printed and any member not having received a copy can do so by application to the Hon. Librarian.

(Signed) D. E. CAUSH,

Hon. Librarian.

63, Grand Parade.

SOCIETIES ASSOCIATED,

WITH WHICH THIS SOCIETY EXCHANGES PUBLICATIONS,

And whose Presidents and Secretaries are *ex-officio* Members of the Society :—

Barrow Naturalists' Field Club.
Belfast Naturalists' Field Club.
Belfast Natural History and Philosophical Society.
Boston Society of Natural Science (Mass., U.S.A.)
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Chester Society of Natural Science.
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Watford Natural History Society.
Yorkshire Philosophical Society.

LIST OF MEMBERS

OF THE

Brighton & Sussex Natural History & Philosophical Society,

JUNE, 1888.

N.B.—Members are particularly requested to notify any change of address at once to Mr. J. C. Clark, 64, Middle Street, Brighton.

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BRIGHTON & SUSSEX

Natural History & Philosophical Society.

ABSTRACTS OF PAPERS

READ BEFORE THE SOCIETY

TOGETHER WITH THE

ANNUAL REPORT

FOR THE

YEAR ENDING JUNE 12th, 1889.

Brighton:

THE SOUTHERN PUBLISHING COMPANY, LIMITED,

130, NORTH STREET, TELEPHONE NO. 52.—(13,334).

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OFFICERS OF THE SOCIETY.

1889-1890.

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Mr. George de Paris.

Vice-Presidents:

(Rule 20.)

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Mr. G. D. Sawyer.
Rev. H. G. Day.
Dr. W. Ainslie Hollis.
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WEDNESDAY, OCTOBER 10th, 1888.

INAUGURAL ADDRESS.

TWENTY YEARS OF THE SOCIETY'S HISTORY.

Mr. J. E. HASLEWOOD, President.

Tradition says that the Brighton and Sussex Natural History Society took its rise from a conversation between four gentlemen interested in Natural History during a ride in a fly from Lewes to Brighton some time in the year 1854. Unfortunatcly, I have not been able to see a copy of the first rules, but the idea of the founders seems to have been to establish a kind of semi-privatc Society, wherein gentlemen interested in Natural History could meet together, read, and discuss papers bearing upon their favourite studies, and more particularly carry on discussions, and so increase their pleasure in and add to their knowledge of the various subjects dealt with by the Society. It would seem that they in no way sought publicity, whilst, at the same time, they must have taken a lively interest in the matter, inasmuch as they obtained 74 members dnring their first year. Their first President was our dear old friend, Mr. Hollis, who has so recently passed away from us. The only gentlemen who then held office and who are now living, are Mr. Simonds (Treasurer), and Messrs. G. de Paris and Barclay Phillips (members of the Committee). The Society commenced the annual excursion during its first year, which excursion was to Ardingly Rocks, and it is worthy of note that it produced two papers, one from Mr. Hollis on the Geological Features of Ardingly, and the other from Mr. A. Wallis on the Flora of the Ardingly district. The Society started vigorously, as ten original papers were read during its first year, besides having many zoological, geological, botanical, and microscopical specimens exhibited at its monthly meetings. Then as now the finances were carefully looked after, and out of a total income of £37 for the year, a balance of £13 4s. 4d. was carried forward to the next year. It is not my intention to trace the early history of the Society any further. It would seem to have gone on quietly and prosperously, so quietly that strangers coming to the town heard of it by accident. I came to Brighton in October, 1864, but I had been here four years before I heard of the existence of the Society, and then it was by an accident. I was elected a member of your honourable Society on the 12th November, 1868. Our present Treasurer was then its President, and I well remember the pleasant impression given me at the first meeting I attended by the bright looks and courteous manners of the President. Mr. J. Colbatch Clark was then occupying the same office he now holds, and which he so ably filled during all the intervening period. I well

remember the paper read on that evening ; it was by our late friend, Mr. Peek, and of course about a fish. It was the custom then to enter upon the minutes the names of those who attended the meetings, and of the seventeen who were present on that evening I believe only five are now living. The first impression I got of the Society turned out to be a correct one, namely, that it was composed mainly of gentlemen who, although busily employed in the various occupations of life, had a great love for the investigation of some one or other branch of Natural History, and were desirous as far as they were able to cultivate the study, but who at the same time felt that their knowledge was of such a kind that it was wiser and better that they should confine their utterances to the comparative privacy of the Society rather than pose before the town as authorities in their particular studies. The Society was in a very active and healthy state during the first year of my membership ; seven papers were read, two of which were written by our friend, Mr. C. P. Smith. The remaining writers have passed away. Amongst them appears the late Mr. Robertson, a gentleman whom many of you will remember as one who, whilst he worked steadily for the Society, was, somehow or other, always in difference. He was a most useful member because he so often had objections and was accustomed to state them in remarkably strong language, and yet with it all he was a genuine favourite. One of the papers was by our late friend, Mr. Wonfor, and was the first, I believe, in which he introduced his theory that the male in Lepidoptera had scales, unlike the females. Many of you are aware that he worked upon that subject for many years, and he claimed to have established the theory as a fact, and as one of his most important works in Natural History. Besides the papers read there were the usual field excursions, which appear to have been somewhat thinly attended, and we also had our annual excursion to Rotherfield and Crowborough, dining at Uckfield. It was during this year that the question arose as to the earliest age at which persons should be admitted members of the Society. The matter was settled then by fixing the time at 20 years. There was, however, a numerous party who thought the age too high, and who wished to encourage youths to join us, and in a few years (1871) the age was lowered to 17. New rules were framed during this year, and they have formed the basis of all subsequent rules until we come to those adopted last year. In all the various rules the management of the Society has been entrusted to the Committee, and although some of our more democratic friends may think this somewhat narrow, there is no doubt in my own mind that the affairs of the Society have been managed much better in this way than they would have been by a more popular mode. During this year (1869) out of a gross income of £53 10s. 8d., the large sum of £29 5s. was spent in new books and periodicals. At that time a very useful practice prevailed ; the current periodicals were placed upon the table on the usual monthly nights, and we each had an opportunity of looking over their tables of contents and seeing whether there was any subject which we wished particularly to read about.

A New Departure in the Society.

In the next year a new departure was taken. Our friend, Mr. Wonfor, secured much fuller abstracts of the papers read; the annual report was enlarged; and these abstracts were published in it, and from them a very fair idea can be gathered of their modes of treatment of their subjects by the various lecturers. It will interest our friend, Mr. Rean, to know that during this year our late esteemed friend, Dr. Hallifax, gave us a paper, entitled, "On the Vertebrate and Invertebrate Eye compared," and which was, as were all the Doctor's papers, most able. Amongst the lecturers was one to whom we always listened with wrapt attention. I allude to Mr. Clifton Ward, a friend of the late Mr. Hennah, and through whose influence, I believe, we were indebted for several most valuable papers from Mr. Ward. The latter gentleman was on the Geological Survey, and was occupied principally in the Lake District. He was a master in his department. Without any written paper, by the aid of clever diagrams, he would make the dullest intellect understand the subject he was dealing with. At this time the late Mr. Gwatkin was our honorary librarian, and a special vote of thanks was passed to him for the accommodation afforded by him keeping the books at his house, and by the great facilities allowed to the members of being able at any time to procure them. And well he deserved such a vote. Many of you will remember that cupboard in the back part of his shop, where our slender Library was then kept, and you will remember still more vividly the pleasant smile with which your application for a book or a periodical would be met, and how our late friend would leave his business occupations to assist us in finding what was wanting. On the 10th March, 1870, an event took place which was exceedingly interesting to me. On that evening it was decided to form a Microscopic Section. Previously to this time microscopic subjects had from time to time been brought before the members at the usual monthly meetings. It was found, however, that in consequence of the numbers taking an interest in microscopic work having increased, the monthly meetings did not afford sufficient scope for them, and it was decided that a monthly meeting should be held for the special purpose of dealing with microscopic subjects. For many years that section flourished. Messrs. Wonfor, Hallifax, and Hennah were the life and soul of it. I have a very pleasant recollection of our numerous meetings, and of the varied information I obtained at them, and more particularly those very instructive and useful evenings in which one or other of the gentlemen I have named would give us a lesson in the use of methods of illumination, the making of cells, and the various methods of mounting objects. Very full and careful regulations were formulated for the conduct of this Microscopic Section The papers were limited to twenty minutes, so as to allow plenty of time for the examination of objects. A cabinet for objects was ordered, a custodian appointed, and strict regulations laid down as to the borrowing, use of, and damage to slides. Whenever we revive the Microscopic Section, and I hope we shall soon do so, we cannot do better than refer to these old regulations, from which we shall

gain useful hints for the good working of the Section. A the same meeting a resolution was passed, whereby it was recommended that members should assist the Secretaries with notes of objects shewn, and abstracts of papers read, so that a full and accurate record of the work done in the Society might be preserved. Of late years we have availed ourselves of the assistance of the Press, and so have not required so much attention to this recommendation; but now that we have again reverted to the old plan of dispensing with the services of the Press, it will be as well that members should have the necessity for some such assistance to the Secretaries brought to their minds, for it *is* of importance that a full and accurate record of the work done in the Society should be preserved. I have been astonished in going over the reports and minutes for the purposes of this paper to find so valuable a mine of all kinds of information stored up in its records.

THE INTRODUCTION OF SOIREES.

On the 11th January, 1872, a great event took place, namely, the first attempt of the Society to give an invitation soirée. It was held in the Board-room of the Dispensary, and proved most successful, about 200 members and friends attending it. One great feature of it was that nearly all the objects contributed were illustrative of papers read before the Society during the previous year. These soirées were continued for many years, and have only lately been discontinued. In April, 1872, we decided to subscribe for the daily weather reports from the Meteorological Office, and that subscription has been kept up to the present time.

VISIT OF BRITISH ASSOCIATION TO BRIGHTON.

In August, 1872, the officers of the Society were in a great state of excitement. The British Association visited Brighton, and the Natural History Society was, as a matter of course, expected to render great assistance to the town in entertaining the members and associates of the Institution. The Natural History Society was asked to furnish microscopes for the two soirées given by the Association, and, thanks to the energy of Mr. Wonfor, about 50 microscopes were got together, and two most interesting series of objects were exhibited. Dr. Badcock specially taking considerable trouble to get together numerous living objects. We all remember how admirably Mr. B. Lomax managed the exhibition of the living Flora. I think the efforts of the Society on that occasion were fully recognised by the town authorities, and, so far as I remember, that was the only, or at least the chie occasion on which the Society has been able to render efficient assistant on a great public occasion. In the following October another great move was made. The Committee decided to ask the Corporation to accommodate us in this building. We were met in the most courteous and liberal spirit by the Town Council, and ultimately it was arranged that we should be allowed the use of this noble room for all our meetings upon condition that we allowed the public the use of our books in the Library for reading in the building only. This arrangement has continued until now, and with equal benefit to the Society, and to the public. We get the use free of cost of a very suitable room, and the public get the benefit of the use of our exceedingly

valuable Library, one which is yearly increasing in value, and where can be obtained scientific books which cannot be had elsewhere in the town. At the time I joined the Society, and, I believe, from its commencement, tea and coffee at the close of the meetings formed an important part of the programme, but in April, 1874, owing, I believe, to some difficulties experienced in the supply, these important adjuncts were discontinued. As you are aware they have recently been revived; they certainly give opportunities for friendly chat over the evening's proceedings, but seeing that we nearly all live within ten minutes' walk of our room I am not quite sure that the Society does well to incur the expenses incident to this mode of refreshment.

THE LATE MR. WONFOR.

Nothing of interest occurred during the next few years until we come to the year 1878, when by the death of Mr. Wonfor the Society suffered the greatest loss it ever sustained. At a meeting of the Society held on the 14th November, 1878, the following resolution was passed: "The members of the Brighton and Sussex Natural History Society desire to record their deep sympathy with and sorrow for the Widow and Son of the late Mr. T. W. Wonfor in the sad bereavement they have sustained. And also to record their feeling of gratitude for and appreciation of the untiring zeal with which the late Mr Wonfor worked for the welfare of the Society as one of its Honorary Secretaries for so many years, and particularly the cheerful readiness with which at all times he assisted each and all of the members who sought his aid on scientific subjects."

However varied the opinions of men might be as to Mr. Wonfor's scientific abilities there was no difference of opinion whatever as to his character. By universal consent he was held to be a most amiable and loveable man, one whom it was a great pleasure to possess as a friend, and one who dearly loved this Society, and in the interests of which much of the energy of his life was spent. To me personally he was a great loss. I always found him ready to assist me in my difficulties, and possessing as he did a knowledge of Natural History far and away beyond any that I had, I often had recourse to his skill, and shall ever feel grateful for the kindly manner in which his assistance was always rendered, and I am sure all those members of the Society who had the privilege of intercourse with Mr. Wonfor will say that the resolution passed by the Society at his death, strongly worded as it is, was none too strong for the occasion. On the 13th March, 1879, the then President of the Society, Mr Mayall, presented to the Society the very fine portrait of Mr Wonfor which now adorns our room, and which, by its vivid life-likeness, so often carries the thoughts of many of us back to the good old times when he lived and moved amongst us. For some years the Microscopical Section flourished, but gradually and principally through the loss of the older microscopists it dwindled down, until in October, 1880, it was decided to discontinue it. Again after a short time, it was revived with renewed energy, but that in its turn became exhausted, and in September, 1885, it was again discontinued. Since then another resuscitation has taken place, but the life was even shorter, and at the present time we are without a Microscopic Section.

Changes in Recent Years.

The Society worked on in the even tenor of its way for years afte the death of Mr. Wonfor. Our friend, Mr. Lomax, undertook the duties of Scientific Secretary, and continued to fulfil them until the pressure of other work prevented his being able to give that attention to the duties of the office which their importance demanded, and he was obliged to resign, the Society appointing Mr. Pankhurst in his place on the 14th January, 1886, and the latter gentleman, not feeling satisfied with the working and condition of the Society, gave us such a shaking up as we have not had for years past, and we now stand before the public as the Brighton and Sussex Natural History and Philosophical Society. Owing to the energy of our new Scientific Secretary we have enrolled a large contingent of members in the town of Hove, and there has been a kind of understanding that the Society should endeavour, as far as possible, to deliver papers at the Hove Town Hall, in the room which the Chairman of Commissioners, Mr. J. W. Howlett, has so kindly placed at our disposal. It will be the duty of your Council to see that this understanding is loyally carried out, and I venture to hope that some of our new members at Hove will assist us in this matter by preparing papers which cannot only be read at Hove, but also at our place of meeting here, especially as the scope of the Society has been enlarged so as to let in almost all subjects of general interest except controversial theology and politics. I cannot refrain from calling your attention to the very valuable and continuous services rendered to this Society by Mr. J. Colbatch Clark. During the whole of the period over which I have been running Mr. Clark has acted as our Business Secretary, and how well and faithfully he has discharged his duties our reports will show. He has kept all our business affairs in perfect order, and, best of all, has not only not allowed us to get into debt, but has husbanded a nice little balance for us to enable us to meet any little needs which the Society is not unlikely to have. It is a pleasure to remember that these services have not been altogether unrecognised by the Society, for on the 8th February, 1872, it did itself the honour of presenting to Mr. Clark, through the late Mr. Hollis, its then President, a clock. In making the presentation the President laid particular stress upon the fact that Mr. Clark had for so many years then past, made such admirable arrangements for the annual excursions, and which had afforded very great satisfaction to all who had attended them. The clock bore an inscription stating that it had been presented by the members as a mark of their esteem and of their gratitude for Mr. Clark's services. I have extracted from the reports the titles of all the papers that have been read before the Society during the last 20 years, and I find that they amount to the very respectable number of 189. Out of these geology takes the first place, there having been 38 papers on geological subjects ; next comes botany with 32, microscopy 15, and anatomy 11. Then follows a descending scale, dealing with various subjects in Natural History. Of these papers the late Mr. Wonfor contributed 35,and when it is remembered that his life only covered half the period with which I am dealing it will be seen how laboriously Mr. Wonfor worked

for the Society. Whenever a lecturer failed Mr. Wonfor always had something ready with which to instruct us. The next highest figure is that of Mr. Pankhurst's, numbering 12; then Messrs. Lomax, F. E. Sawyer, and Dr. Hallifax, 11 each; the late Mr. Hennah, 7; and so we go on descending until we come to the number ones, of whom there are 31, amongst whom I am sorry to say my own name is to be found. In looking over the records of these papers I have been astonished to find what a vast amount of information they contain; 'tis true that the record varies very much. At times we have broken into fits of generosity and the substance of papers have been printed in our reports, but usually the record is meagre, and not at all what it should be for such valuable productions, and I hope a way may yet be devised so that, without incurring unreasonable expenses, a full record of the papers read by the members may be kept. Of course the papers vary in value and interest, but it would be invidious to attempt to specialise any of them. One cannot, however, look with anything but deep interest on the productions of such men as Dr. Hallifax, and Messrs. Wonfor, Hennah, Scott, Robertson, Howell, and others. There used to be one feature of our annual and field excursions that should not be forgotten. I refer to the very valuable sketches which our dear old friend, the late Mr Penley, used to produce for our portfolio, and which now bring back to us many scenes and circumstances which would otherwise have been forgotten. Other artists, too, used to help in this pleasant work, but they all seem to have died out or left us. I think it is a long time since we had any such sketch. The Society's library has gradually become a most valuable and important one; from those small beginnings when a cupboard in Mr. Gwatkin's shop was sufficient to hold them, it has grown to be the finest scientific library in Brighton, and it has been made doubly useful by the excellent catalogue which the Library Committee has recently got out. I am glad that these books are made useful to the public at large. Indeed, I am told that the public make more use of our library than our members do themselves. Our microscopic cabinets, too, are now well furnished, and I hope that we shall be able to carry out some arrangement for the use of the slides by the members. From time to time the Society has attempted great things, such as laying down schemes for an examination of the fauna and flora of the County of Sussex, and the appointment of Sectional Committees for that purpose, and also the delivery of popular lectures to the public on scientific subjects. I am very sorry to be obliged to come to the conclusion that we are not strong enough for these things. For the most part we are composed of busy men, who take up science as a recreation and who have not the time, and few have, the ability to deal with such matters. It may seem a lame conclusion, and I do not like it myself, but a long experience of this Society has convinced me that until a younger and more energetic class of members joins us we cannot do more than go on in our old-fashioned ways, and we must content ourselves as best we can in so doing. I have often thought we ought to make something more of our annual and field excursions so far as science is concerned. They did so in the early stages of the

Society, but I fear very much that there are not sufficient of us to undertake the work involved, and I am still more doubtful whether those who accompany us on such excursions would appreciate any such efforts. They have come to the pleasure excursions merely, and I fear they must remain so. I cannot help hoping that we may again revive our microscopic meetings, and that we may be able to put them on such a basis that they may not again become the ephemeral things they have been in the past. I know there are many difficulties in the way. I give place to no one in my love for microscopic work and studies, but I know how it was when I was practising my profession—no time was given me for any but the most desultory work, and as it was in me, so it is now in the large number of those who would otherwise gladly work at the microscope. Our soirées, too, have dropped out of our programme. I hope to see them revived, not, however, as annual things. It is quite impossible year after year to bring together sufficient new material to interest a large audience, and whenever they are renewed I hope it will be under conditions which will make them pay their way instead of being a heavy burden upon the Society's finances. Their renewal will rest mainly with the members. As soon as they will bestir themselves and hunt up objects of interest for exhibition and take a considerable share in the work of preparation the thing can be done. Our Secretaries must not be left to do the whole of the work. I would venture to suggest that those members who are anxious to revive our soirées should form themselves into a Committee, and see what they can do in the way of obtaining scientific novelties for exhibition, and generally in getting up an interesting evening, and particularly in stirring up our own members to attend, and also to assist in interesting onr visitors. By some such means as these we may hope to gather in new recruits, especially among the young, and so increase our pleasure in and the usefulness of our Society.

The Benefits of the Society.

Some of you may ask, well, what has the Society really done during the last twenty years? I can only speak for myself. To me it has been invaluable. Its meetings have been sources of unalloyed pleasures, one has constantly met with kind friends and courteous helpers; ignorance has been removed; narrow conceptions have been broadened; the reasoning powers have been cultivated and strengthened; and one has got nearer to the heart of that great mystery which Nature presents to the thoughtful man. It may seem odd to many of you, but I have no hesitation in saying that I have been a much wiser and better lawyer by reason of my having been a member of your Society than I should have been without such membership. I take it that I have been a fair average member, and what it has been to me it has been to most others who have interested themselves in its work. The memories of the pleasant intercourse which one has had with men like the late members, Hollis Hallifax, Hennah, Wonfor, and others, is an abiding influence for good. Thanks be we have numbers of such men still amongst us, and the heart must be hard indeed that does not feel a thrill of pleasure in still being able to meet and discuss matters relating to Natural

History with such men. As to our future I cannot say much. I am no believer in spasmodic efforts. I think things grow naturally. As soon as you begin to force them they may apparently flourish for a time, but they soon become weak and feeble. I am a firm believer in the progress of science, and I also believe, unhealthy as the soil is, that it will grow in Brighton, and I am sure that in due course, by watching its opportunities and doing all it can to bring its influence to bear upon the public, this Society can, and will do much to further the study of Natural History, and, if you will, philosophy, in this town. And as in the present so in the future. Many who have had the benefit of its influence and its teachings will rise up, as I do this evening, to express gratitude and thanks for the many social and intellectual advantages arising from being a member of the Brighton and Sussex Natural History and Philosophical Society.

NOVEMBER 23rd, 1888.

DINNER OF THE BRIGHTON AND SUSSEX NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.

During the thirty-five years of its existence, many pleasurable gatherings have taken place in connection with the Brighton and Sussex Natural History and Philosophical Society, but never until this evening had a banquet organised within the Society been held. Of course dinners had been held on the occasion of rural excursions, but the members of the Society had never met together in Brighton for the one purpose of dining together and spending a social evening. The idea, with whomsoever it may have originated, was a happy one, as a more effective method of making members realise that they belonged to a Society, and of inducing them to take a deeper interest in it, could hardly be imagined. Happily conceived the idea was successfully put into execution. The banquet was held at Markwell's Hotel, and here was found a room of just sufficient size to comfortably accommodate the members who had expressed their intention of attending, and three or four guests who had presumably been invited on account of the distinguished position which they hold in the town or the sister town of Hove. The company was not large. It consisted of perhaps not more than a quarter of the total number of two hundred members enrolled in the Society, but it included many of the most active members and of those who most regularly attend the business meetings. As President of the Society, Mr. J. E. Haselwood occupied the chair, and he was supported

on his immediate right by his Worship the Mayor of Brighton (Alderman Sendall), the Chairman of the Hove Commissioners (Mr. W. J. Howlett), Mr. F. Merrifield (the Clerk of the Peace for Sussex), and Mr. C. A. Woolley (the Town Clerk of Hove), and on his immediate left by Mr. Seymour Burrows (the ex-President of the Society), Alderman Cox, Alderman Davey, and Mr. G. D. Sawyer, while at the ends of the table, facing one another, sat the Hon. Secretaries of the Society, Mr. J. Colbatch Clark and Mr. E. A. Pankhurst. Among others present were Dr. Badcock, Mr. J. Dennant, Dr. Ewart, Mr. Daniel Friend, Mr. D. B. Friend, Mr. A. G. Henriques, Mr. Aleck Hill, Mr. Marshall Leigh, Mr. C. Lever, Mr. B. Lomax, Dr. McKellar, Mr. G. de Paris, Mr. Henry Prince, Mr. Petitfourt, Mr. W. H. Rean, Mr. Rogers, Mr. H. Shaw, Mr. W. Smith, Mr. Thomas Smith, Mr. J. Thomas, Dr. Whittle, Mr. John Wood, Mr. Walter, and Mr. Isaac Wells. The company, indeed, was of a very convenient size, large enough to give the gathering importance and make the proceedings interesting, but sufficiently small to make it sociable. Good management everywhere prevailed, and thus the evening passed in an exceptionally pleasant manner. A *recherché* repast was served soon after seven o'clock, and two hours having been occupied in dining, a few toasts were submitted. In this respect the Society set an example which might well be followed at similar meetings. The toasts were only five in number, but they were exceedingly appropriate, and were dealt with in a brief and interesting style. The speeches, to use the President's own expression, shewed a happy combination of "sense" and "nonsense," though in the place of the latter word might very well be substituted that of "humour."

The President himself struck the key-note in a few introductory remarks which he made, after due honour had been done to the toast of "The Queen." The success of the gathering, he first explained, was due, in a great measure, to the ex-President, Mr. Seymour Burrows, and to their two worthy Hon. Secretaries, Mr. Pankhurst and Mr. Clark, and then he went on to enumerate the toasts, as, being obliged to indulge in small economies, they had not been able to provide a toast-list. This little duty over, he expressed the pleasure it gave them to welcome the Mayor and the Chairman of the Hove Commissioners, who, he remarked, was practically Mayor of Hove, and assured those who might think that they had made a false move in holding the dinner that there was no danger of lovers of Natural History becoming gluttons. He maintained that they wanted their social qualities educated quite as much as other qualities, and meetings of that kind tended very much in that direction. They knew what a disagreeable animal an unsociable man was, and if they did not cultivate sociality they would become unsocial, for qualities not used after a time became lost. Having assured the company that he was not going to inflict them with a long speech, Mr. Haselwood in a humorous way, reminded them that sometimes in their discussions they had tried to picture their last man on the face of the earth, and in the same strain proceeded to argue that man was gradually going, and to give an idea of what he might be expected to develope into. Amid laughter, he

remarked that man was certainly losing his hair, and, in the course of further observations, stated, that according to certain authorities, the man of th efuture would lose his teeth, his ribs, and his toes. The result of the loss of the last-named members of the body, the speaker remarked amid laughter, would be that man would develope the hoof. He then proposed "The health of the Mayor," pointing out to the Chief Magistrate how much there were in natural history which would be useful to him in his profession, and, having described the amicable relations which had always existed between the Society and the Town Council, paid a tribute to the personal worth of the Mayor, and assured him that he had the sympathy of the members of the Natural History Society, and might rely upon their support in conducting the business of the town.—The Mayor was very short in his remarks, but he happily expressed himself in acknowledging the words of Mr. Haselwood and the hearty reception of the toast.

Alderman Cox, in proposing "the health of the Chairman of the Hove Commissioners," thonght it most suitable that the toast should follow closely that of the Mayor of Brighton, for he had always found that Mr. Howlett took almost as much interest in the prosperity of Brighton as of Hove. He said that he entertained some fear lest the President should have applied his argument of the decadence of man to the Brighton Town Council, and expressed himself a believer in evolution rather than in decadence. Connecting this thought with natural history, he laid stress upon the value of pursuing its study, inasmuch as it taught people to think.

Mr. Howlett, who announced to the company that the President and he hailed from the same county by addressing him as a "brother Norfolk dumpling," likened himself to the Mayor in being like a fish out of water in the presence of such a learned body. He assured the members of the Society that he would assist them in every way he could, and invited them to visit Hove more often than they had hitherto done.

Mr. G. D. Sawyer was the next speaker, and he gave the toast of "Prosperity to the Society." He claimed the Society were useful in many ways, and not least in providing recreation for its members, especially professional men, whose business brought them worry and care. But, above that, it was a means of inducing to study, and he thought it was fully entitled to be considered a learned Society.

The toast was duly honoured, but no one responded on behalf of the Society. Almost all present being members, it would, perhaps, have been hardly the thing.

The next speech was perhaps the neatest of the evening, and it was eloquently expressed. Mr. F. Merrifield was the speaker, and he submitted the toast of "Literature, Art, and Science," He explained the connection between the three, and again their connection with the Brighton and Sussex Natural History and Philosophical Society. It was pleasant, he remarked, to couple the three together—Literature, the heir of so lengthened and glorious a past; Science, with the promise of so brilliant and beneficent a future; and Art, which he supposed might be described as superior to time altogether. He coupled with the toast the names of Mr. Henriques, Dr. Ewart, and Mr. de Paris.

Mr. Henriques, limiting himself to two portions of the wide term literature, namely history and fiction, regretted that history was not more truthful, and expressed his opinion that the prospects of literature were of the very brightest.

Dr. Ewart reminded the company of the great progress science in all departments had made during the last generation, and, speaking more particularly with regard to medical science, looked forward to great triumphs in the direction not only of curing disease but of preventing it.

Mr. De Paris, whom the Chairman introduced as one of the founders of the Society, would not regard art as the least of the three, "Literature, Science, and Art," though it was placed last, and shewed the use of art in the study of Natural History.

The Mayor then proposed "The health of the President," and the toast having been heartily drunk, the Chairman responded in appropriate terms.

Between the toasts the Orpheus Glee Union rendered some glees in capital style.

WEDNESDAY, NOVEMBER 14th.

COLOUR BLINDNESS.

Mr. W. H. REAN, M.R.C.S.

The questions involved in colour-blindness are not only of interest to the scientist and the physician, but also to the student of social life ; for what vast issues may depend on the power to discriminate rightly the fundamental colour of the spectrum.

The signalmen on our railways as well as our sailors have thousands of lives constantly dependent on their due appreciation of the difference between red and green.

The subject may be conveniently treated under three heads :

1st : Light and colour in themselves, and theories respecting them.

2nd : The nervous sense within the brain by which they are distinguished, and

3rd : Means of testing individual faculties by which colour is perceived.

1st : Taking the generally accepted undulatory theory of light as the true one, light is due to an infinitely rapid vibratory motion communicated to the ether and propagated in spherical waves. These transmitted to the retina call forth the sensation of vision. Newton discovered that a ray of white light may be broken up by a prism into a series of colours. To this band he gave the name of "spectrum." It was long considered that red, yellow, and blue were the primary colours of this spectrum, but of late years the most distinguished physicists have pronounced for red, green, and violet.

2nd : The instrument of vision—the eye. Of its different parts the retina is the most important of the subject of the paper. It is a delicate transparent membrane containing the terminal organs of the optic nerve. Under a powerful microscope no less than ten layers may be detected in a section of it. Of these the layer of rods and cones is the most important. It is through these rods and cones that it is supposed the vibrations of the luminiferous ether are transformed into those molecular movements which, transmitted to the brain, give us the sensation of light. It is a curious fact that that portion of the brain which is connected by the optic nerve with the retina is incapable of receiving other sensation but that of light. Speaking generally our colour-vision is defective insomuch that there are vibrations outside the red and violet which do not, under ordinary circumstances, affect the retina. Again, there are individuals who can perfectly distinguish between gradations of light and shade, and yet are quite incapable of distinguishing not only between gradations of certain colours, but even colours themselves. It is impossible to say whether Helmholz's theory is the true solution of this difficult problem.

This defect of colour vision is often congenital. It is more prevalent than is generally supposed. Prof. Dowden found that, out of 2,300 railway employés, 6·6 per cent. were colour blind. Dr. Jefferies, of New York, found that out of 10,387 persons 4·149 per cent. were so. Out of 1,000 persons personally examined the result was 5·3. The general average is about 4 per cent.

Colour blindness may sometimes be due to defective education of the colour sense. Persons may be either unable to distinguish any colours, every object appearing white, black, or grey, or they may be blind to all red rays—the most common form—or to all green rays ; or, lastly, to all violet rays. A red-blind person would distinguish the difference between red and green only by one being brighter than the other.

3rd : As to the tests by which this defect of vision may be detected. Coloured lights have been suggested, but there are objections to them. The method generally adopted is by a series of wools specially dyed for the purpose, and arranged in a certain order.

To the green-blind, for instance, red and violet produce the sensation of white or grey. Purple, being composed of red and blue (or purple) is, to the colour blind, identical with blue.

A red-blind person will match a bright red with a green, the only distinction between them being a little difference in brightness. But then it must be remembered that he will call the red accurately crimson or scarlet, as the case may be, though the word he uses conveys to him only the impression of another shade of green. Thus, hundreds of persons live and die in entire ignorance of their peculiar want of perception, and even those with whom they are most familiar are as ignorant of this defect of vision in them as they are themselves.

WEDNESDAY, JANUARY 9th.

THE NECTARIES OF FLOWERS.

Mr B. LOMAX, F.L.C.

The somewhat miscellaneous collection of organs which are known by the convenient name of nectaries have lately assumed an importance which was not recognised by the older botanists. A hundred years ago it was an accepted axiom of Natural History that all things were created for the especial use of man, and that every organ, or modification of an organ, had a direct relation to his sustenance or comfort. When, therefore, it was discovered that certain appendages to cruciferous flowers had the power of secreting honey, and were on that account visited by bees, it was at once assumed that they were of no use to the flower, but were added for the express purpose of supplying man with a delicate and nutritious article of food.

Modern research has changed all this. We know now that the nectary plays a very important part in the life history of the flower, and that the visits of insects are Nature's means of securing to a large section of the Vegetable Kingdom the advantage of cross-fertilization. To a large section, but to a section only. Many plants are fertilised by the wind alone. The grasses and the catkin-bearing trees have no nectaries. Producing enormous quantities of pollen, in anthers lightly suspended and protruded from the flower, the stimulating granules are borne in clouds upon the summer breezes, and the pistils with their large feathery stigmas catch them as they pass.

The possession of a nectary is a proof that the flower in which it occurs is insect fertilised, but many plants without nectaries also depend upon the visits of insects. The honey bee, and many other Hymenopterous insects use pollen for food, and anyone watching a hive in summer may notice the workers carrying in large quantities of this material packed in balls upon their hind legs. Many plants depend upon the pollen itself to induce insects to visit them, and such flowers have pollen of a brilliant colour and in considerable quantity.

The form of nectary which first attracted the attention of botanists was that of the wallflower. In this, as in other cruciferous plants, there are four long stamens arranged in a square, and two stamens curled outwards at the base so as to appear shorter. This bulging, which is necessarily shared by two of the sepals, is caused by the presence of four small green organs which, from their position, were supposed to be aborted stamens. It seems, however, more in accordance with recent enquiry to look up on them as glands, projecting from a glandiferous membrane lining the whole surface of the receptacle.

Adopting this view, we find perhaps the simplest form of nectary in the campanula. Here no special glands are produced, but the whole surface produces nectar, which flows into the angle formed by the calyx and ovary, and there collects for the use of the insects, who cannot possibly reach it without brushing against the overhanging stamens. In the Marvel of Peru, Stephanotis, and Jessamine, this portion of the

plant is prolonged into a narrow tube, obliging the insect to walk over the petals, and so displace the anthers of the epipetalous stamens.

In the Mignonette, the glandular surface is raised into a high ridge, which is nectariferous, and the polyadelphous stameus inarch over it, their bright orange colour directing attention to that particular spot.

In the majority of nectariferous flowers the nectary is at the base of the petal. The genesis of these nectaries is well shewn in a few closely allied plants belonging to the Ranunculuceæ. The Adonis has a spot, not in the slightest degree nectariferous, just above the claw. In the common buttercup this becomes a hollow, covered by a thin scale. In the hellebore the hollow is so much deepened that the whole petal becomes a tube. In the Myosurus the hollow extends down the claw itself. In the other orders we find further developments. Thus the Berberry has two nectar glands at the base of each petal. In the fritillary the hollow of the buttercup is lengthened laterally into a furrow; while the hollow petal of hellebore extends into the long spurs of the Tropæolum, Columbine, and Honeysuckle.

The separate glands of the Cruciferæ are repeated in many other flowers with variable numbers. The Parnassia has branched scales at the base of the petals, with nectaries on each branch; and the Violet has nectaries projecting from its stamens.

The students in search of nectaries should choose a hot summer's afternoon, when the honey-like scent of the hedgerows shews that the nectariferous glands are secreting copiously. Mindful of the requirements of insects he should direct his attention to such flowers as have bright colours or rich fragrance, and wherever petals are marked with veins, stripes, or deep notches he may expect these guides to lead him, as they doubtless do the insects, to the concealed storehouse of insects.

During his investigations he will be able to discover the contrivances, scarcely similar in any two species, whereby the insect, in gratifying his own appetite, is made to serve the life-purpose of the flower, and thus will be able to form a judgment on the larger question of which this is but a small part—the relation of insects to flowers.

WEDNESDAY, MARCH 13th, 1889.

THE ORIGIN OF SPEECH AND DEVELOPMENT OF LANGUAGE.

Miss AGNES CRANE.

The question of the origin of speech, which is, in a measure, distinct from that of the subsequent development of language, was selected in consideration of the wider range of subjects your Society afforded by the adoption of the title of a Philosophical Society. There are, at least, five kinds of natural language or means of expressing ideas and eelings : (1) Sign or gesture language ; (2) the disjointed cries which invariably precede the development of articulate speech (3), just as the picture word (4) was antecedent to the development of written language (5). This last, we may remember, passed through successive stages, from the picture word or portrayal of the actual object, to the ideogram or picture of ideas, or the representation of objects for the value of the sound of their names, ultimately attaining unto complete phoneticism in the use of arbitrary alphabetical signs as symbols of sounds. All these developments are intimately connected. It is not improbable that sign or gesture language, which is the mother tongue of the deaf and dumb, preceded the development of articulate speech among primitive men. There is certainly abundant proof that it played a very important part in the earlier stages of oral communication. Then the gesture acted, in fact, like the pictured word in the first development of written language ; it determined the meaning of the idea intended to be conveyed. In fact, it is a form of pictured word describing outlines in the air, as well as by pointing out the actual objects. Among modern savage tribes gesture still largely supplements spoken language, and we ourselves resort to it when in difficulties as inarticulate tourists in foreign lands, for it has this advantage over articulate speech, it is cosmopolitan. To the deaf and dumb sign-language is a picture language. It originates independently in the minds of deaf mutes, who understand each other by signs, whether they are Germans, Laplanders, or American Indians. We still use the finger to lip to signify silence, indicate the height of a person or thing by placing the hand above the ground—the deaf mute sign for little ; point "Go there" ; beckon with the fore-finger for "Come here," and this finger is called the index-finger, and is placed on our walls and in our streets as a picture-written direction. Our syntax depends on the language we speak. Primitive man had no syntax at all. Gesture language has the natural order of syntax. First comes the noun, then its qualification, the object before the action. "Horse black bring" ; "Hungry bread me give" ; are examples of sign-word sentences. The negative is expressed and not the postive. The syntax of the American native tongues resembles that of gesture language, which has no copula and no auxillary "to be." That fascinating writer, E. B. Tylor—the Darwin of anthropology

—regards action as better than words for telling simple story. The Cisterian monks still use it exclusively. The Italian pantomimists skilfully expressed meaning by gesture, and it is extensively used by the Indian interpreters among the various tribes who habitually employ gestures, stress and tone as essential aids to vocal utterance. With us to-day grimace and gesture survive merely as an adjunct to oral language in the actor and orator. Picture writing also is still represented by the arrow and the index hand indications of flight or direction,in the full moons and half moons of our almanacs,the ideogram in the rebus, and hieroglyphical symbols on printers' proofs and medical prescriptions. Colonel Garrick Mallery's fine work on "The Pictographs of the American Indians," shews that they are great adepts at picture-writing, for the chiefs kept their census by it, counting heads and recording names in a very methodical manner.

"Language most shews a man,—
Speak that I may see."

wrote Ben Jonson, Shakespeare's most appreciative contemporary, and some modern philosophers still hold with Aristotle that the possession of articulate speech is the sole distinction between men and other animals, many of which communicate with each other by inarticulate cries, tones, and gestures, having thus an intelligible language of their own, which man has not wholly mastered. No one would deny the vocal powers of birds ; indeed, we compliment a human singer by comparison with a nightingale. The vocal organs of a magpie or parrot are so highly developed that articulate language is imitated to such perfection that the phrase "He speaks like a parrot" has become part of our language, and is used alike of a schoolboy or politician who repeats words without realising their meaning. But the bird's powers stop there. He imitates words and extends their meaning by association, but does not originate. In some respects the voice organs of birds are more highly developed than those of the mammalia. Modern ornithologists class the singing birds highest. The vocal organs are alike in the nightingale, which pours forth exquisite melody, and the crow, which never rises beyond that conversational "caw, caw," whence its name of "*Krakra*" was alike derived in the ancient language of India, and that of "*Kahkah*" in British Columbia. The production of inarticulate cries, tone, and resonance is also characteristic of the mammalia as a class, and there is a certain progressive organic development and specialised modification to produce the bray of the ass, the roar of the lion, the purr of the cat, and so on. Among birds additional air sacs for the increase of the volume of sound are frequently enormously developed, and in those American monkeys which give utterance to such fearful cries as to fully merit their name of "Howlers." An African species, the *cynocephalus*, or dog-faced monkey, figured on ancient Egyptian monuments, utters sounds which sometimes contain a distinct consonantal D, and clicks resembling the inarticulate clicks in the speech of the Hottentots and Bushmen. Of animals nearer to man we may cite the gibbon, which Professor Owen says almost sings in semitones and has a range of an octave. But man alone combines the simple sounds of consonants with vowels into complex sounds or yllables, thus forming word-signs to convey to another the impressions

he has received or the notions he has conceived. It was long before the association of one sound with one idea became fixed and definite. The primeval utterances of mankind were scarcely rational and almost unintelligible.

Few persons now attribute the compilation of the first vocabulary and grammar to the Creator, and Assyrian scholars have recently deprived us of a refuge in "Babel," or *Babilum*,* which it is said does *not* signify confusion of tongues. There is strong evidence that language did not result from any sudden outburst of inspiration, but was unconsciously and naturally developed by social Man, the desire to communicate with his species being, according to Whitney and practical philologists of his school, the most influential factor in its development. Other writers maintain that it necessarily resulted from man's advance in civilization, and that the invention of useful implements, such as the seine fishing net, which gave employment to the hands of a number of individuals united in pursuit of a common object, was a step furthering the development of articulate speech, inasmuch as the hands could not be simultaneously employed in signs or gesture language. M. Noire believes that in the inarticulate rhythmical cries still uttered by workmen in hauling weights, rowing, and marching, to secure unity of action, we have an example of one method of the origin of language. This Mr. Romanes has recently named the "Yo he ho" theory, considering it merely as accessory of the imitative and interjectional modes of development which Prof. Max Muller formerly satirised as the "Bow Bow" and the "Pooh Pooh" theories. To gain a full realization of the condition of language at the interjectional and imitative stage we must have recourse to the farm yard,or,better still,to a heated public meeting, when so-called civilized nineteenth century man frequently and deliberately reverts to the inarticulate condition of his remote ancestors and meets with the hoot of the owl, the hiss of the goose and the serpent, with dismal howls, or the inarticulate groans and moans of his own childhood, the arguments of a speaker whose logic and facts are incontrovertible. The aborigines of Ceylon also mark their disapproval by "iss," but these wild Veddahs are never known to laugh and cannot even remember the names they gave to their own wives in their absence. The Basutos and the natives of the New Hebrides hiss like geese to express their admiration. Many words in every language may be considered as derived from imitations of the cries of man and other animals, such as peewit, cuckoo, howl, screech, hiss, hum, buzz, in our own. Sanskrit yields *kshu* to sneeze, *kakh* to laugh, *kas* to cough, *ma* to bleat. Coptic *ah ha* to laugh, *eioio* to wear a sorrowful countenance. We can all recognize the ancient Egyptian name of the animal they were the first to domesticate,—the *mau* and *aua* for cow. The Chinese also call the cat *miou*, and our pussy is as probably an imitation of the angry cry of that animal; Irish *pus*, Erse *pusag*, Gaelic *puis*, Tamil *pussi*, Afghan *pusha*, Persian *pushak*, *boosi* in the Tonga islands from the very day Captain Cook introduced it to the natives, and in America pwsh, pish-pish.

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* A. H. Saye; in By-Paths of Bible Knowledge, vol. II. Religious Tract Society, 1888.

The physiological aspect of speech must now be considered, inasmuch as there are many psychologists who profess that animals do not articulate solely from lack of the necessary mechanism and not from any deficiency in mental powers. The investigations of the eminent biologist, M. Paul Broca, tend to localise the *faculty* of speech in a very circumscribed area, more especially of the left cerebral hemisphere of the brain. The organ occurs on the upper edge of what is termed the "Sylvian fissure" opposite the "so-called island of Reil" in the posterior half of the third frontal convolutions of the right or left hemisphere. On the right side it is but feebly developed, but any lesion or disease of "Broca's organ" on the left side is frequently accompanied by inability to use words rightly and aphasia, or entire loss of speech. The power of making appropriate gestures or sign language remained unaffected in as many as eleven out of sixteen cases recently noted. The mechanism of *voice and of articulation* really depends on two essentials, air and muscle. The rhythmical contraction of the diaphragm, a muscular plate separating the thoraic from the visceral cavity, with the mobility of the lower ribs, draw into the lungs the air necessary for existence. The forcible contractions of the muscular cellular lung tissues expel the returning current, and it is chiefly by means of the air thus breathed out from the lungs that tone and resonance are produced at will; therefore we use our spent breath in speaking, and do not really waste it even in the most futile argument. The expired air passes silently out through the upper windpipe, into a box-like prolongation of the upper gullet called the *larynx*, whenever the passage is unobstructed. The voluntary erection of the two movable membranous half-valves of which the free edges form the vocal chords and are stretched tense, relaxed or shifted by the laryngeal cartilages, causes the returning air wave to pass through the narrow fissure (the glottis) so formed, and sets the vocal chords vibrating. The tone thus produced passes on, either through the nasal cavity, or, if that is already closed, by the muscular elevation of the soft palate, it escapes freely into the mouth cavity in vowel vibrations, if the jaws be wide open, or is differentiated into consonants by the varying degrees of mouth closure, the movement of the lower jaw, contraction of the lips, and of the glottis, the elevation and depression of the palatal cavity, and the movements of the tongue. It depends, therefore, entirely on the soft palate, which is largely concerned with the production of vowels, whether the sound be a nasal resonant or produced through the mouth. The larynx is the chief tone-producing organ. It can be elevated and depressed, and is entirely supported in the cavity of the gullet by the "U" or horse-shoeshaped bones and cartilages (*os hyoides*), to which some of the muscles of the tongue and palate are attached. This hyoid arch is suspended by ligaments fixed to the upper jaw of the skull. It has also important muscular attachments to the inner edge of the point of union (or symphisis) of the two rami of the lower jaw and to the sternum and the inner edges of the shoulder blade. In fact, the hyoid is the mainspring of articulation, and the degrees of ossification of the central cartilages of the arch increase with middle life, and become completelv ossified in old age among the European races, a result which has been attributed to

irritation by muscular action during articulation. A recent discovery in this direction affords interesting evidence of progressive change in the articulating organs of the human race. A large number of fully adult skulls, some of quite aged individuals, were disinterred from the ancient cities of Southern Arizona by the "Hemmenway Expedition." In no case were the three small cartilages forming the arch of the hyoid ossified in these neolithic crania. A similar feature was observed to be presented by mummies from the ancient Ancon cemetery of Peru. Dr. Wortman, who made this discovery, is convinced that it is a modification directly resulting from the fact that the native languages of America are pronounced with little effort on the part of the speaker. An Indian, it is said, can talk for hours at a stretch without being fatigued, the tones are restrained and not produced as with us. Hence, it is argued, this retention of the cartilaginous condition of the central portions of the hyoid arch throughout life.

One of the most important muscles connected with articulation is that which rises from the hyoid, passes under the tongue, and is attached to an eminence situated on the lower jaws at the point of their union. This ridge, called the genial tubercle, is not developed in monkeys nor in anthropoid apes. Mortillet and other writers have maintained that its absence in the lower human jaws of fossil men of the "river drift" epoch found at La Naulette and Schipka favoured the hypothesis of the former existence of a race of "speechless men," to whichHœckel gave the specific designation of *Homo alalus*, assuming that like their collaterals, the anthropoid apes, they lacked the power of articulation. But scientists do not all welcome the concept of "speechless man" with equal enthusiasm.* It is obvious, however, that the power of articulation is progressively acquired. It commences in the child shortly after the union and ossification of the two rami of the lower jaw, which takes place generally a year after birth, and developes more or less rapidly with the mental growth. Many savage tribes never completely attain a full articulation. The confusion between the consonants, so frequent a characteristic of the lower forms of language Max Muller admits, reminds one of the lack of articulation among the lower animals. Liquids like *l* and *r* are frequently interchangeable. In many Polynesian dialects the natives either lack, or have lost, the power of distinguishing between them. The gutturals *k* and *c* cannot be produced at the beginning of a word ; hence the Tahitans called Captain Cook Captain Tuke, just as an English four-year-old child might do. Nor can they pronounce final consonants, and would call cab "taba," in the same way in which they Polynesianised the English name of book into *buka buka*, forming the plural like children by reduplication, when those articles were introduced to them by the Missionaries. The consonants *r* and *l* are likewise interchangeable by many South African tribes, and among the Dravidian races of India. Many adult English persons fail to pronounce *r* rightly. "H," produced with much effort, and often misplaced with great care, is still badly used amongst us and *v* substituted

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* The weakness of the morphological evidence at present forthcoming does not affect the logical postulate.

for *w* by Cockneys, like the immortal Weller. Some Australian dialects have only eight consonants in their alphabets; the American Tinnes have 63. Prince Lucien Buonaparte gives 390 as the *maximum* of phonetic sounds in all the languages of the world. The sibilants offer difficulties to many persons, but these lispers do not emulate certain modern savages, whose lisp results from the wilful filing away of front upper teeth and the removal of four lower ones. Among Pacific Coast tribes the adoption of nose and lip ornaments interferes with the enunciation of the nasal and labial consonants. These are but trifling instances of the effects of custom on language. The is no *d* in Chinese, and no classical Chinaman ever pronounces the letter *r*; he says "Eulopa" instead of Europe. Mandarin, therefore, is not a true Chinese word, being derived from the Sanskrit *mantrin*, a counsellor. The Huron and Mohawk languages of North America possess no labial consonants whatever. The gutturals, entirely absent in the dialects of the Society Islands, abound in Semitic tongues, and often form the basis of the triliteral or three-letter consonantal roots characterising that ancient group of languages.

There is no *l* in Zend or Old Persian, and the initial *s* is always replaced by *h*, as in the Sanskrit word *samâ*, for summer, which becomes the Zend *hama*. Hence, in transferring the Sanskrit name of river *sindu*,it becomes Hindu. The Greeks passed it on with the soft aspirate and so we get our name India as the equivalent of *sindhu*, or the country of the seven rivers. The Aryan group of languages is also characterised by a regular alternation of consonants, which is known as Grimm's law, after the philologist who formulated the important discovery. No etymologies can be regarded as sound if these phonetic changes have not been fully considered. They are, however, quite distinct from the irregular "phonetic decay" to which the consonantal sounds are especially subject in all languages, and which result mainly from laziness and a desire to pronounce words with the least effort. For example, our word "speech" should be spreech, as it is derived from the A. S. sprecan, O. H. G. spreckan. It lost the "r" about the 11th century and is certainly pronounced more easily without it. The laws affecting consonantal change and vowel variation have not yet been fully worked out in the Asiatic, American, Polynesian, and Australian languages. In the African Kaffir a certain regularity has been noted already by Bleek. It is possible that consonantal variation may be somewhat affected by physiological causes. Experiments have recently been made at Boston, U.S.A., among the boys of the Latin and High Schools, ranging in age from 12 years to 20, which tend to shew the occurrence of a large percentage of deficiency of sound perception, which has been rather absurdly named "sound blindness." The fact that a good ear is as essential to a linguist as to a musician or a vocalist has scarcely received the attention it merits from the scholastic profession.

We must now dismiss from our minds the idea of language as we are accustomed to conceive it; for the investigations of philologists reveal the indubitable fact that primitive language was scarcely intelligible. Its phonetics were certainly variable in the extreme, and it mattered little how sounds were pronounced. There was, moreover, a stage in its development when the word did not clearly define the idea,or

represented many ideas, of the most opposite signification. Tone, grimace and gesture then largely determined the meaning of the infantine babble of mankind at large, and supplied the place of the absent pronouns and adverbs. At that epoch language consisted mainly of one word. Whether that word was a single word of one syllable, like the Chinese root-word, or a sentence word or "bunch word" of the polysynthetic or "much putting together" type philologists are by no means agreed, nor can they be said to be unanimous in opinion as to whether that primeval monosyllable or sentence word was noun or verb Probably both schools are right and it partook largely of the nature of tho noun, the adverb and the verb. In Polynesian dialects almost every verb may be used without any change of form as noun or adjective. This is equally true of the speech of the African Bushmen. In Chinese the root-word *shi* means "food" and "to eat" also. Bunsen states there is no formal distinction in the ancient Egyptain language between noun, verb, and particle. There are survivals of this primitive condition of things in our own language. We still employ adjective nouns as chestnut-horses" "black-board," or qualifying substantives as iron stone" and "feather-grass." We speak also of giving a present, we present a gift, and of the present time; stress and the position of the word in the sentence determining the sense. Languages in the earlier stages of their development are devoid of prepositions and auxiliary verbs. Dr. Brinton states that no conjunction occurs in any of the native American languages. Evidently primitive man did not connect his sentences. On consideration he was not singular in that respect. Perhaps we may look on modern examples of this habit as interesting cases of reversion. Some American tongues have no adjectives; others, like the "Cree," but few. In some as many as 18 pronouns have been developed,—"the rank growth of a new soil." Many, on the contrary, have none at all, personal, relative, or possessive. But there are large numbers of individuals even in so-called civilized countries that have not yet learnt to distinguish between *meum* and *tuum*. No grammatical gender was developed for a long period. Objects and ideas were divided into living things and non-living things—the animate and the inanimate conjugations which prevail alike among uncivilised tribes in Asia, Africa, America, and Polynesia. Or gender was a relative affair, and did not depend upon sex, as in the case of the Ongobs of West Africa, who place everything great, noble, and desirable, and of value, including Man, in the masculine, and all things small, insignificant, and of no value, including Woman, in the feminine gender. To the savage at this epoch of mental development there was "no time like the present," and the verbal nouns of "epicene words" were devoid of distinctions of tense, person, and number; emphasis, tone, and gesture eked out their vocabularies, and the pause often changed the whole meaning of a word or placed it in another class, as in the Guarni of South America, wherein "*Peru o 'u*" meant "Peter ate it," but "*Peru ou*" meant "Peter came." The oldest known language is the hieroglyphical language of ancient Egypt, which can be traced back more than five thousand years. When compared with its direct descendant, the

modern Coptic vernacular, which ceased to be spoken in Egypt about the seventeenth century alter Christ, it reveals much concerning the origin of language, and explains as "survivals" many apparent anomalies in linguistic stocks of later growth. It has been said that the ancient Egyptians had many ideas but few words, but the present degenerate inhabitants of that eventful land, if modern travellers may be believed, have but one idea, and express that in the Persian word "backsheesh"—adopted into the Turkish language. (Zend *baksh*, to distribute; Sanskrit, *bkaj*, to divide.) The Coptic, which differed as much from the hieroglyphical language as modern English from the parent Anglo-Saxon stock, has become a sacred and dead language and Arabic, a Semitic tongue, now prevails throughout Egypt. It has been, perhaps, too hastily assumed that no neolithic man knew how to write, but it seems as though we could never reach back to an age when the Egyptians were ignorant of that art. Nor is it possible to tell exactly when the stone ages ended, and the historical period dawned in Egypt. Stone implements *unpolished*, and, therefore, true palæoliths derived from the breccia from which the "tombs of the Kings" were hewn at ancient Thebes, are full of significance, telling of the existence of palæolithic man and of the great antiquity of the human race on the black soil of Egypt, long, long anterior to the development of the hieroglyphical system of writing, which we know had been perfected nearly six thousand years ago. This must necessarily have been long after the spoken tongue had become sufficiently fixed in sound and sense to permit of its being recorded by pictured word, ideogram, and hieroglyphical phonetic symbol. It is at present impossible to arrive at even the approximate date when the rude hunters of the "river drift epoch" lived on the site of ancient Thebes, or to measure the lapse of time between their day and that of the full attainment of the splendour of the civilization of the ancient Chemi, or Black Land. Menes, of the so-called first dynasty, ruled about 4400 B.C. A first examination of the hieroglyphical language suggests that every word had every meaning, or that every meaning was expressed by every sound. In fact, as Dr. Abel tells us, we seem to have before us a language almost presenting the phenomenon of unintelligibility. It is this very condition—which necessitated the continuous employment of tone and gesture as determinants in the spoken language, and of the added object pictures in the literary form—that has rendered possible the decipherment of the hieroglyphical inscriptions.

The same word or sound had several meanings. There are many words evidently formed by the mere reduplication of the primitive syllable, such as: *sensen*, to breathe, etc., *kenken* to strike; *men*, to stand, became *menmen* to move, after the same fashion. On the other hand we get several words for one idea. Thus *an*, *ten*, *tem*, *temi*, *mtes*, *sa*, *sat*, and many others all meant "to cut"; and *karo*, *bari*, *kaka*, *kaku*, *kek*, *kebn*, *kebni*, *sehir*, and full twenty more were used for "ship." Many instances occur of inversion of sound as well as of inversion of sense and often sense and sound were inverted at the same time, *ab* reversed becomes *ba* both signified "wall" as well as "stone"; *am* meant to come and so did *ma*; *ar* was "to make" and so was *ra*, *as* or *as* alike signified both beautiful and miserable, and a woman with dishevelled hair was the pictorial determinant for grief; *sef* to wash

reversed becomes *fes*, to wash and to clean. Inversion of sound, the formation of dissyllables and concurrent development of many words with the same meaning originated in many instances after the following method:—The initial consonant of the stem root was sometimes repeated at the end, or it was transferred there. In this way *fes* became fesf and by lingering pronunciation fesef, hence in time *fes* meant to wash and *sef* also. Again, *ker* became *kerk*, in the same way *ker rek*; and later both *ker* and *rek* signified to turn round, to revolve, to rotate. The initial *u* in *ush* "immense," transferred to the end became *shu*, with the same meaning, and *osh* or *sho* signifies "much" also. There is, moreover, ample proof that the ancient Egyptian defined his ideas by contrasting them with their opposites. Hence one word had not only different meanings, but sometimes expressed the most opposite ideas. He arrived at the idea of strength by contrasting it with feebleness, *ken* meant both strong and weak; of light by contrasting it with darkness, *sam* darkness, *sem* to become light. Sense is often inverted as well as sound, as in *ben* "nothing," *neb* "all;" *kar* wise, *raka* stupid; *mer* left hand, *rem* right hand. These are not isolated examples, but selections from thousands of instances recorded by Dr. Abel from the "hieroglyphical language" of Egypt. In Coptic each vowel had specific import, augmenting the meaning and intensifying the sense. "O" sonorous was such an intensive. For instance, *bel* to loosen became *bol* to liberate; *talshe* to cure diseases became *talsho* to alleviate the sorrows of the soul; *take* to kill became *tako* of annihilate or work wholesale destruction. Thus Plato's theory to the significance of individual letters in the Greek and other alphabets is proved by Coptic grammarians to possess some truth. The phenomenon of the same sound conveying the most opposite significations is certainly very remarkable, but it is not confined to the Egyptian language. It occurs abundantly in the Arabic and in the literary Chinese of the period 2,000 B.C. There are relics of this mental phase in linguistic development in the more highly organized European tongues.* In German, *boden* signifies ground floor as well as loft; in English, "down" means below as well as a slight elevation, like our South Downs. That the preposition "with" in the sense of conjointly signified also "without" is proved by the existence of words like withdraw, withgo, and withhold. "To bid" means to offer as well as to command. "Better," the comparative of good, is derived from bad. *Melior*, though derived from *malus*, is the comparative of *bonus*. The Sanskrit *vara* means "good," but the derivatives Icelandic *ver* and Gothic *wairs*, like the English one, signify worse. The Sanskrit "Deva," bright heaven, God, supplied old Persian Daêva, an evil spirit. In Great Russian *blagi* signifies both good and bad; *dobhr* good and bad also. That tongue yields an interesting example of both sound and sense: for *bar*, the Russian word for master, inverted or spelt backwards *rab*, yields the word for slave in that language, and "Bar" is the oldest root form of an ancient Russian title of nobility, boyarin, literally "a master of slaves," or the titled slaveholder, in that former land of serfs.

* "Slavic and Latin" and "Linguistic Essays. By Dr. Karl Abel.

In these examples, which might be greatly multiplied, we get actual confirmation by the philologist of the postulate of the logician, inasmuch as the facts Dr. Abel records as occurring in various languages, Professor Bain in his "Logic" demonstrated ought to take place in the following quotation which elucidates this point. "The essential relativity of all knowledge, thought, or consciousness, cannot but show itself in language. If everything that we can know is viewed as a transition from something else, every experience must have two sides; and either every name must have a double meaning, or else for every meaning there must be two names. We cannot have the conception 'light' except as passing out of the dark. We are made conscious in a particular way by passing from light to dark and from dark to light. The name light has no meaning without what is implied in the name dark. We distinguish the two opposite transitions light to dark and dark to light, and this distinction is the only difference of meaning in the two terms 'light is emergence from dark; dark is emergence from light.' Now the doubleness of transition is likely to occasion double names being given all through the universe of things; languages should be made up not of individual names but of couples of names." Such names are "heat, cold;" "up, down;" "motion, rest;" "good, evil;" "sweet, bitter;" "rising, falling;" "something, nothing;" "full, empty;" "strong, weak" (Bain's logic, vol. i., p. 54). This is a very happy instance of the co-operation of the sciences. Moreover, there comes such strong confirmation from the New World of this identical phase of defining notions by contrasts with their opposites as to suggest that it was universally characteristic of the earlier stages of the development of language. In a paper entitled "The language of Palæolithic Man" recently delivered before the Philosophical Society of Philadelphia, Dr. D. G. Brinton notes the occurrence of similar instances from the Nahuatl of Central Mexico, the Cree and the Tinné of North West America. From the Tinné, a member of the great Athapastan linguistic stock, he cites:—*Tezo* sweet; *tezon* bitter; *ya* immense; *ya* very small. We can easily supply the grimace and gesture which differentiated these meanings. *Son* meant good and *sona* bad. From both Cree and Tinné Dr. Brinton adduces proofs opposed to Max Müller's views that the vowels, "A., E., I., O., and U., and consonants like S and K standing alone are without significance." Various philologists have noted the fact that in many tongues widely separated, both in structure and distribution, the sound "M" conveys the subjective relation, and N and K were primitive demonstratives. In Tinné the significant radicals are the five primitive vowel sounds. The 63 consonants also have a material meaning, and are divided into nine classes. Each class conveys a series of related or associated ideas in the native mind. A similar division of ideas and objects into classes Bleek has demonstrated exists among the Swahli tribes of East Africa. Some anthropologists believe that the persistent efforts of the ancestral "gesticulating ape," or "grunting ejaculating man," to attain the erect posture and walk uprightly nearly proved fatal to the race. The picture painted by the philogist of the modern savage struggling for existence, to arrange, define, and express his ideas, merits our

sympathetic consideration. It is a conception far removed from Sir John Lubbock's description of the brutish, sensual, thieving savage. Surely more is here involved than the mere grammatical distinction between the abstract and the abstracting savage. There are two sides to the same question. But the primitive speech of mankind was necessarily far more rudimentary than the rudest dialect spoken by the lowest savage. Dr. Brinton states that "the language of palæolithic man had no grammatical form. So fluctuating were its phonetics, and so much depended on gesture, tone, and stress, that its words could not have been reduced to writing, nor arranged in alphabetical sequence; it possessed no prepositions, nor conjunctions, no numerals, no pronouns of any kind, no forms to express singular or plural, male or female, past nor present, the different vowel-sounds and the different consonantal groups conveyed specific significance, and were of more import than the syllables which they formed. The concept of time came much later than that of space, and for a long while was absent."

The postponed discussion of this part of Miss Crane's paper took place at a special meeting on March 27th, when the President (Mr. J. E. Haselwood), Mr. E. A. Pankhurst, Mr. Petitfourt, Rev. H. G. Day, and others, took part in an interesting debate, lasting two hours.

WEDNESDAY, APRIL 10th, 1889.

THE ORIGIN OF SPEECH AND DEVELOPMENT OF LANGUAGE

(SECOND PART.)

Miss AGNES CRANE.

It is evident that the primitive language of mankind was necessarily of a very simple character. Variable in sound, shifting and vague of sense, the associated tone, stress, and gesture acted as a supplementary determinant in what might, perhaps, be called the invertebrate and protean conditions. The grammatical categories, the chief conserving element in the construction of language, were for a long time absent, and they have not yet been fully developed in many dialects of modern savages in various stages of culture in all parts of the world. Some of the effects of custom on language in its primitive conditions are somewhat remarkable, for words are changed, lost, or replaced by others with extreme rapidity. It has been computed that tribal dialects vary with every third generation, and missionaries have often found carefully compiled vocabularies useless after the lapse of ten or twelve years in the same region. The names of the five principal numerals have been changed in Tahiti since the days of Captain Cook. Such verbal variations frequently result from observance of a singular custom. Whenever the name of a person is identical with that of an object, or closely resembles it, and the individual dies, the name of the object is immediately dropped out of the language and a new one

invented and substituted for it. This custom really originates from the rigid observance of a rule of never mentioning the names of the dead, and it is closely connected with the worship of ancestors and the idea that the spirits of the dead can work both good and evil to the survivors, and must not be called back, but be propitiated alike by offerings and sacrifices. This idea causes the use of much periphrase among the Australian tribes. In Siam the King must never be directly named, but alluded to in a very roundabout manner. The name of a chief is always tabooed in the South Seas. One New Zealand chief was called *Wai* or water, and a new name *pope* had to be invented for water, another, evidently a sharp fellow, was named *Maripi*, or knife; henceforth knives were *nekra*. Among African tribes the Kaffirs drop from their language words resembling the names of a former chief. Hence the Zulu word for sun, *ilanga* became *isota*, because of their ruler Uhlanga. In these stages of culture, marriage customs affect the language. The Antillian Caribs generally steal their wives from alien tribes, so the language of the men differs from that of the women. Elsewhere a man may not pronounce the name of his mother-in-law or sister-in-law, and a woman must likewise omit all reference to her father-in-law or brothers-in-law. The Kaffir women have, therefore, developed a language of their own. If any of their husband's male relatives is called, say, *Uhmelo-amehlo*, eyes, the *usifazi* or women no longer use the word *amehlo* for eyes, but substiiute for it *amakangelo*, or lookings. If one were called *Nkombo*, she would not use *inkombo* for cow, but would invent another name for the domestic animal. Moreover, it is not etiquette in savage society to name things or potentialities which are supposed to be hurtful. Hence the Dyaks never refer by name to the small-pox when that pestilence prevails, but anxiously inquire, "Has he left you?" The Yesidis worship an individual who is usually nameless in polite society even unto this day, but refuse to mention his name Sheitan, and gave up using that for river, "shat," as being likely to be mistaken for it. Among African tribes, the proverb about the devil being "not so black as he is painted" would be reversed, because they always paint him white, out of compliment to the superior powers, ability, and knowledge of the white man. It is possible that a similar idea suggested to the Chinese the uncomplimentary designation of "foreign devils" indiscriminately applied to all aliens in that empire.

After this fashion custom has caused frequent changes in the vocabularies of savage tribes. But it is also to custom, and one mainly dictated by human vanity, that we owe the formal preservation of extinct languages and the records of bygone civilisations and empires in both worlds. The most pronounced Democrat, were he also a philologist or a philosopher, would readily admit the use of kings and queens and autocratic rulers of Empires. Had they not been respectively impelled by a desire to record their names, acts, decrees, and ordinances on rocks, temples, monoliths, and palaces, on clay brick, cylinder, silver tablet, or papyrus we should have known absolutely nothing of the ancient language and history of Egypt. We should have been ignorant also of the old Accadian tongue and the culture of the kingdoms of North and South Babylonia, of the empire and

language of the Semitic Assyrians, who subsequently established their domination over them, and of the Peruvian, Maya, and Aztec civilisations of the Western World. The confusion of tongues and admixture of nations has increased our knowledge, for the decipherment of one decree has often served as a guide to the rest, and it is noteworthy that a ruler's name and titles have always proved the first clue to these hieroglyphical records in all lands. The pursuit of this, the only royal road to learning with which I am acquainted, yields up to the patient philologist the formal structure of long dead languages, throws fresh light on the construction and affinities of kindred living members of the same linguistic type, and illustrates the successive mental and material phases in the development of language in general. Step by step we can trace the inception and growth from the rudest picture word of the graphic systems of the polysynthetic languages of the American Continent, the less agglutinative Accadian of Babylonia, the isolating Chinese, the inflected dialects of Semitic Assyria, Phoenicia, and Arabia. as well as for Aryan, Persian, and the more ancient Egyptian tongue.

We now approach two of the most difficult problems of philology,—the development of roots and the origin of the different linguistic families or genera, to which the one thousand surviving specific languages are respctively affiliated. Grammar is the permanent framework of language, roots are the backbones—the parent stems of later word formation. To a comparatively small number of roots languages are ultimately reduced by analysis; that is to say philologists can get no farther, but it must not be assumed that this ultimate solution represents the original ideas of the primitive framers of language, or the first sounds in which they expressed them. There are 500 roots in Chinese; Renan gives the same number for Hebrew. Coptic has been reduced to about 700 word stems, and Max Müller has recently resolved the 450 Sanscrit roots to 120 concepts, or mother ideas, expressing actions and being. Many of these, as even Max Müller admits, are capable of originating in the rhythmical cries accompanying concerted action, as M. Noiré has suggested. Such verbs Romanes well shews to be exactly those to be best fitted to survive as roots. He further reduces these 121 concepts to about one hundred. Max Müller maintains that every idea that passed through the mind of India as revealed in its literature can be traced back to these 121 concepts, and the words that have been derived from them by extension of sound and meaning. He adds that there are few concepts in English, or Latin, or Greek, which could not be expressed with the words that have sprung from these Sanscrit roots, and "that every thought that ever crossed the mind of man can be traced back to about 121 simple concepts" (Science of Thought," pp. 417 and 418). These comprise such words as to milk, to gather, to dress, to adorn, to bake, to sew, to weave, to hate, to think, to know, and to measure. Proof enough, if all other evidence were lacking, that these people were in a relatively civilised condition very far removed from that of primitive man. Surely it is obvious we must seek farther back than this for the first developed roots of language.

The development of the child repeats the history of the race. Let us turn to some of the more remarkable phases of the development of natural nursery language, of which the full importance was first recognised by Dr. Horatio Hale in his Presidental address to the Philological Section of the American Association for the Advancement of Science in 1886. Max Muller states in his "Science of Language" that children do not invent a language of their own. Dr. Hale cites two cases of children born with a speech inventing faculty. In one instance twin boys invented and conversed in an intelligible language of their own for several years. They had ultimately to be forced to learn their mother tongue like a foreign language. In another case a little girl four and a half years old invented a language with her younger brother. The syntax in these children's language differs as well as the vocabularies and resembles the syntax of deaf mutes and gesture language. The adjective qualifies the noun and comes after it, The object before the action. Still more significant is the fact that one word has several allied meanings. In another case, noted by Herr A. Von Gablentz, of a child who called things also by names of his own invention before he learned his mother tongue, we get the remarkable fact of the employment of different vowels to denote smallness or greatness. This child called a little doll's chair *likill*; an ordinary chair *likail*; and a great arm chair *lukull*. His root for round objects was *m-n*. He called the stars *min, min, min*, a watch or plate *mem*, a round table *mum*. This is an extremely interesting case of natural vowel modification. Dr. Tylor had previously pointed out that any child can see that a scale of vowels makes a most impressive scale of distances, and that many pronouns and adverbs have probably arisen from this simple device, although the same vowel is not always employed to denote nearness or to signify remoteness. His list of sounds for "this" and "that," "here" and "there," is a very interesting one, and could be considerably extended.* It would seem as though the crêches of our large towns offer unusual facilities for the study of so peculiar a branch of philological enquiry as the spontaneous development of roots and the order of the production of the consonants and their natural alternations, although the conditions might not facilitate calm scientific observation. But the children of the poor are for obvious reasons brought up by children of but little larger growth, and the use of such spontaneous root-words might, therefore, be prolonged among them. Directly the children mix with adults their special language dies out, often, probably, unrecorded. Archdeacon Farrar had noted that the neglected children in some of the Canadian and Indian villages, who are left alone for days together, do invent a language for themselves, and African children are known to develop a special language also under similar circumstances. Like Winchester school boys, the younger members of some African communities speak a different language among themselves before they are admitted as members of the tribe. Special hunting and war jargons are occasionally invented by adult savages distinct from their every day speech, and they really seem to delight in puns and shifting word development.

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* See "Primitive Culture," by E. B. Tylor.

The origin of articulate speech among the speechless race of the river drift epoch, Dr. Hale attributes to some such child genius with an abnormal faculty for its development. *The diversity of root stocks*, of which the greater part occur in the Western World, he thinks may be accounted for by the wanderings of single pairs from primitive communities at a period when the population was scanty, and their complete isolation would be secured in those primeval wilds. The subsequent early death of both parents, by some accident of the chase or otherwise, left their young children alone to develop a language of their own, and invent their own mythology. It is a noteworthy fact, according to Major Powell, that, as a rule, the myths are distinct in each linguistic family. The elder children might retain a recollection of some of the words of the parental language, and this would account for the actual identity of certain words in languages belonging to widely separated families, otherwise totally unrelated. This may be a perfectly accidental coincidence naturally resulting from the comparatively small number of possible articulations. Such young children, Dr Hale admits, could only survive in an equable climate, where food was easily procurable all the year round, like that of California. The fact that 19 distinct stocks occur there, and many more in the mild regions of Brazil, is certainly in favour of his hypothesis of the origin of the diverse linguistic stocks whence varying dialects radiated in all directions with the rapidity characteristic of the uncivilised regions of all parts of the world. Blood feuds and intertribal wars are frequent, and divide a tribe into separate portions. If they hold no future intercourse, in a few years neither section could understand the other. The varied and numerous meanings given to—one word on the one hand, and the frequent application of the same sound for ideas of the opposite significance on the other—both pre-eminently characteristic of the early life of language—materially assist this process of variation, and tend to promote the adoption of different meanings for the same idea by the different tribal sections. Multiply this process indefinitely, and we easily attain to the contemporaneous existence of innumerable divergent tongues, as on the American continent, which yield the philologist to-day more than four hundred distinct native languages at present affiliated to 130 different root-stocks. The same condition characterises Polynesia, Melanesia, Australia, and Africa. The traveller meets with a fresh tribal dialect every hundred miles or so in Mongolia and Thibet. Numerous divergent tongues are spoken by the primitive non-Aryan population of Southern India, known to philologists as the Dravidian race. Some of these, Tamil, for instance, are of a highly polished character, and like the "clear sounding" Nahuatl of ancient Mexico and the Bantu of South Africa, have independently attained a measure of perfection on different lines of evolution.

The progress of civilization, however, tends to reduce the number of dialects. When one community becomes more powerful or highly civilised than its neighbours, it enforces its own language on the subordinated tribes, which become its tributary allies in war. Thus Nahuatl was understood by numerous tribes of the Nahuatl confederacy. Similar conditions prevailed among the six nations of the Iroquois in

the North. It was the policy of the Incas of Peru to enforce their own language on the various tribes they conquered, as the governmental or official language. After the conquest a million of the aborigines abandoned their various native dialects and adopted Spanish as their mother tongue. In Europe had not the Romans vanquished Carthage Phœnician Hebrew might have been the classical tongue of Europe instead of the Latin. The Latins conquered the Etrurians and Etruscan survives in a few fragmentary inscriptions. The Arabs conquered Persia, and modern Persian is largely diluted with Arabic. The Turks overran Persian and incorporated Arabic words into their own agglutinative tongue. Russia still forbids the printing of little Russian dialects, spoken by 15,000,000 of her subjects, and compelled the Poles to abandon the use of their mother tongue; they may not even pray aloud in Polish. Austria discourages the Czech of Bohemia, and imposes German on her Hungarian officers, who must perforce give up their native Magyar, a rich and flexible agglutinative member of a non-Aryan stock. In just the same way the Teutonic Norsemen of old grafted on the Anglo-Saxon stock the Norman-French they had themselves previously acquired as a foreign tongue in Gaul. In the early stages of civilization the balance of power is more easily destroyed; confederations of tribes are often dependant on the superior cunning and power of one man. Such domination is rapidly dissolved on the death of the supreme chief, as was recently the case with Mtesa's great kingdom in Central Africa, and the deposition of Cetewayo destroyed the conquering Zulu nation, whose language was understood by thirteen tribes, and was rapidly spreading over South Africa before we checked its propagation. Then the different communities break up again into smaller sections, relapse into barbarism, and the process of the unification of dialects is temporarily arrested. On the other hand the fact that contiguous languages are frequently found to differ widely from each other can be partially explained by the concomitant existence of two such centres emerging from barbarism. These, once permanently established in widely separated areas, radiate and extend their influence in different directions, gradually modify or exterminate intermediate dialects, and ultimately come into direct contact in thus respectively enlarging their borders. So varied and apparently contradictory are the natural forces acting and re-acting on the development, nay the very existence, of primitive languages. Of the death of languages and dialects we can cite modern and ancient example from every linguistic stock and all parts of the world, the Semitic, Assyrian, the agglutinative Accadian of Asia. The Coptic ceased to be spoken in Africa in the 17th century. A few inscriptions are all that survive of Etruscan in Europe, and Celtic-Cornish died with the last century. Four native dialects of Tasmania have become extinct since the colonization of Australia. Thus we have two distinct elements at work, the forces of barbarism tending to multiply dialects and the growth of civilization promoting the unification of languages.

The axiom that human nature is pretty much alike all the world over may fairly be applied to earlier phases of the development of myths and of language. The physical conditions, material surroundings and rude social organization being identical, primitive men

would of necessity pass through the same experiences everywhere. We may, therefore, expect to find a certain uniformity of psychological development, of which the phase of defining ideas by contrasting them with their opposites, previously noted, from languages of the Old and New Worlds, may well serve as example. The fact of the separate evolution of the different graphic systems from picture writings and the adaptation of hieroglyphical symbols as representations of sounds in languages of the chief linguistic stock of the world, is evident proof that the mental phases continued to develop on the same lines of natural development. Professor Sayce tells us that even the highly specialised languages of the Semitic family afford traces of a condition when the personal pronouns were not verbally differentiated, of the existence of a noun of multitude affixed as a sign for plural, and of the use of three numbers, the singular, the dual, and the plural for many. The names of the numerals in many languages prove them to have been formed by the habit of forming the fingers. The decimal system of reckoning seems almost universally based on human anatomy. Finnish *lokka* means "to count" and "ten" also. In Tahiti *rima* was once the name for hand and five, and *lima* is still used for five in Malay. In Zulu five is *edesanta* or "finish hand," and the verb *komba* "to point" means also seven, the number of the index finger. We find such combinations as "band one" for six ; hands for ten ; two on the foot for 12 ; and 15 is *ipititiret*, or whole foot ; *mo bande* or "a person finished" is the word for 20 among the Vei of Africa, and the Aztec word for the same number *cempoualli* signifies one counting. Our very distinctions of grammatical gender result from the habit of dividing objects and ideas into classes developed alike by the African Zulu and the Tinne of America. Such are some of the simple beginnings of language.

Languages have been classed in various ways. The simplest of all methods was, perhaps, that of the Greeks, who divided them into two groups. In the first they placed Greek, and in the second all other tongues which they called "barbarous." Philologists are, however, mainly agreed that there are three great groups into which languages generally may be divided, namely, the isolating stage, the agglutinative phases, and the inflectional conditions. By some these are regarded as successive epochs in the life of language through which each linguistic family has passed in some stage of its existence. There are, moreover, isolating languages which seem to border on agglutination, and agglutinative tongues which approach nearly to the inflectional conditions. A few, like the Etruscan and the extensive Caucasian family, which includes the Georgian, as yet evade strict classification. The monosyllabic Chinese is the best known type of the isolating stage, thus named because there are only 450 so-called root-words in this language —450 sounds with more than 40,000 meanings solely produced by accent, tone, and the position of the word in the sentence. About 1,500 of these verbal modifications are in general use ; and 44,500 are recorded in the Imperial dictionary of Kang-hi, of which fully one-half are obsolete and employed only in the ancient literary language, which can be traced back fully 4,000 years. In the Annamitic dialect of Chinese the syllable *da* has 23 distinct meanings, and it is said the

Chinese syllable "*Ba, bá, bà, bâ,*" if properly sung and arranged, signifies "Three ladies gave a box on the ear to the favourite of a Prince." We see how much depends here on vocal utterance as distinct from mere articulation. M. Terrien de Lacouperie not long since announced his belief that Chinese, as now spoken, forms a link between the agglomerating Accadian and the Finno-Hungarian divisions of the Ural-Altaic linguistic stock. He also maintains that the ancient Chinese hieroglyphs known as "*Ku Wen*" are derived from the later or running form of cuneiform, and that the Chinese monarch Dunki or Dunkik, who traditionally introduced them into China, is identical with the Chaldean king Dungi of ancient Babylonia, who is believed to have reigned at least 3,000 B.C.

The language spoken by the Accadians, who are generally credited with the invention of the hieroglyphical symbols, subsequently developed into the cuneiform or wedge-shaped method of writing, is a member of the agglutinative order, to which the majority of existing languages belong. These are widely distributed in Polynesia, Australia, Northern Asia, Southern India, and Africa. By many philologists the incorporating Basque of Pre-Aryan Europe and the polysynthetic languages exclusively restricted to the American continent are considered to be more highly specialised phases of agglutination. Others maintain the latter to be wholly different in construction and as forming a fourth and perfectly distinct order of languages. By agglutination, literally "a much sticking together," is meant that method of forming words by the multiplication of affixes to the root. Each word or syllable retains more of its distinctive features, and the word can be decomposed, like our familiar compound "untruthfully," which is an example of this method of word formation. Here the prefix "un" is Saxon, as in *undo*; "true" is derived from the Teutonic root *treua*; "ful" from the German *voll*; and "ly" is the residue of our adverb "like," A.S., *lice*. There are numerous phases of agglutination, from mere extension of root by simple reduplication to the most complicated forms of agglomeration. Some are prefix-languages, like the Ba-ntu of South Africa, while, as in some Polynesian tongues, the additions are postfixed to the root. The Asiatic Accadian was a simple form. In Europe we have the intrusive Turkish and the Finno-Hungarian, the most rich, flexible, and polished members of the Ural-Altaic stock, characterized by the harmonic sequence of vowels, that is to say, the vowels of the accruing affixes are modified so as to harmonise with the vowel in the root to which they are loosely jointed. The Pre-Aryan Basques, one of the oldest and most interesting races of Europe, now found only in the extreme western provinces of France and Spain, once spread over a much larger portion of the continent. They have been identified with the small, dark, long-headed Iberian race, which, according to Professor Boyd Dawkins, inhabited Wales in the neolithic age, "long before the Celtic vanguard of the Aryans had set foot in Britain." The various dialects of the Eskuaran or Basque family are still spoken by 600,000 persons in South Europe. The literature dates back no farther than the 15th century. The Basques retain many primitive ways, and practise a modification of the Carribean custom of the *couvade*. By some the race is allied to the Berbers of North Africa,

and through them to the Modern Egyptians, who are, however, a long-headed race. The Basque language is one of the most ancient in Europe and one of the least known. The native words "knife" and "pick" and "axe" preserve the record of the neolithic, or newer stone age in Europe, when those useful implements were really made of stone. The name for axe is *aitz cora*, from *aitza*, a "stone," and *gora* "lifted-up"; that for pick is "*aitz urra*," *urra* meaning to "tear asunder"; and that for knife is *aitz ttoa*, "a little stone." The language is remarkable for the way in which the words are incorporated or run together in one holophrastic or whole phrase word. There is a tendency to believe that the sentence-word was the primitive form of speech. This phase is more or less a characteristic of the native language of the American continent, and of them alone. These for the most part consist of cumbersome sentence-words formed by the union of different words, syllables, or even letters of other words all run into one, sometimes in such a contracted form that it s difficult to recognise their separate parts. The Algonkin word for "sled" is *midamaidutsada*. In Aztec the name of the beautiful red-necked bird, the roseate spoonbill, which is also given to a month in the calendar, is *Tlauhuechol*,* formed out of *Tlauitl*, "red ochre," and *Quechtli*, "neck or shoulders." The name for egg is *Tototetl*, out of *toto* "bird," and *tetl* "stone, *i.e.*, stone-like. The American languages express many things we leave to be inferred.

Lastly come the inflectional order of languages, of which the Semitic family is the only one characterised by true inflection, that is to say, internal change and grammatical form are effected by vowel modification. It is a very old and very interesting group, partly Asiatic and partly African. They are called Semitic tongues, because they are supposed to be spoken by the descendants of Shem, the son of Noah, and all are more or less closely related one to another, scarcely differing more than the various Teutonic dialects among themselves. Like the races who spoke them they have varied less in proportion than any other family. The elder Phœnician, Syriac, Hebrew, and Assyrian were first supplanted before the Christian era by the Aramaic and that in turn by Arabic, now the dominant Semitic vernacular. All the dialects are collateral descendants of some long-extinct fundamental Semitic language. They are alike characterised by the three consonantal or triliteral roots. For instance, in Arabic the consonants "Q T L" form the root of the concept of killing. The vowels are only indicated by signs in written languages. They are employed as the special agents of inflection, and the leading distinctions of sense are formed exclusively by their aid. Thus *quatala*, "he killed"; *quitila*, "he was killed"; *Uqtul*, "kill." In Aramaic *Kâdhêlanâ*, "killing I" *(ana)*; and *Kâdhlath*, "killing thou" *(at)*. Metaphor is freely employed and enhanced by vowel modifications. Arabic has spread more widely than the rest, and is extensively incorporated into Persian and Turkish and also into Spanish. A Semitic jargon spoken in Malta is the only European form. The Semitic are foreign or dead languages in Europe. The original home of the stock is now considered to be Africa, and, although distinct from all other stocks, it is believed to have most affinity with the Hamitic. This includes, among others, the

* "STANDARD OR HEAD-DRESS?" By Mrs. Zelia Nuttall. Vol. 1. No. I. Peabody Museum Reports, Cambridge, Massachusetts, 1888, p. 39.

ancient Berber of Northern Africa, the modern Coptic descendant of that old Egyptian tongue which, partly monosyllabic, in part disllyabic, agglutinative by simple repetition of syllables, and inflected by reason of vowel change and intensification, seems as if it combined characters which subsequently became differentiated and highly specialised in the chief linguistic types of the world.

The great Aryan group is divided into ten families. First comes the Aryan or Sanskritic, the mother of the modern Aryan languages of India and of Romany or gipsy, of which there are no less than thirteen dialectal varieties. Next the Iranian family, comprising Persian, Afghan and Kurdish. Third ranks the Armenian, intermediate between the Asiatic and the European branches. Fourth, the Greek. The fifth family comprises only the Albanian language. Sixth comes the important Italic family, believed to the nearest allied to the Celtic, or seventh family, including the Celtic tongue spoken by the Galatians of St. Paul's Epistles, the Gaelic, the Irish, Scotch, and Manx, and the Southern group of Welsh, Cornish, and Armorican. The great Teutonic family, or East and West German, comes next. The Eastern includes the Gothic, Scandinavian, Swedish, Danish, Norse, and Icelandic or old Danish, the oldest member of it. The Western Germanic includes Frisian, English, Saxon or Low German Frankish and Dutch, and the Upper German dialects. The Baltic family is ninth, and comprises old Prussian, extinct for 300 years, the Lettish and the Lithuanian. Last comes the Slavonic family, including Russian, Bulgarian, Servian, Croatian, Slavonic, Czechish or Bohemian, and Polish. Some of these natural families are more closely related to each other than others. They are all descended side by side from one primitive parent Aryan language as yet unknown to us, and to which Sanskrit was formerly considered to bear the nearest affinity. Of late, however, the Baltic family, comprising the extinct old Prussian, Lithuanian, and Lettish, has been claimed as nearest allied in its simple structure to the parent Aryan speech. There is a strong and growing tendency to look on North Europe as the original home of the Aryans, whence the various tribes may have migrated southwards, following the courses of the great rivers and reaching India last. The Aryans certainly came from a cold country, because there is a Sanskrit word for winter *himá*, Latin *hiems*, French *hiver*. Those equivalent for snow,—Sanskrit *nyavâ*, Latin *nivés*, French *niége*; and the Zend for ice *isi* or *usu*, O. H. G. *is*, German *eis*, E., ice,—prove less, as the effects of ice or snow might be felt in the mountainous regions of a warm land. They were an agricultural people, whose very name Aryans comes from *árya*, "to plough, to stir up," Latin *arare*,—hence our "arable" and the Celtic *arathar*. They domesticated cattle, which constituted their wealth—*paysu*; old Prussian *peku*; Gothic *faihu*, *feoh*,—our "fee"; and Latin *pecus*, *p cunia*, and English "pecuniary." They called their daughters *duhitar* or Milkmaids, Gothic *daughtar*; O. H. G. *tohtâr*, and Lithuanian *dukté*. Our Aryan ancestors were acquainted with silver, or the white stone, and gold, or the yellow stone, and made weapons of bone, of stone, and of wood; the Sanskrit name for wood *dru* means spear also. They spun, woved, dyed, baked, cooked, and brewed as well, if Max Müller's identification of the *soma*, glorified as libations to the gods in the

Vedic hymns with a decoction of the hop plant, be a correct one. They had names for law, *dhâ* to settle, *dhâman* law, and for ship, in Sanskrit *naus*, in Zend *navi*, our "navy." In fact, it is evident the Aryans were comparatively a highly civilised pastoral people, far removed from the rude condition of wandering, hunting, ancient man.

In this way languages yield us a stereotyped picture of the mental and moral phases and material surroundings of the people that spake them. Tithes and taxes are certainly among the most ancient institutions, for records from both hemispheres prove the existence of collectors of tithes and gatherers of taxes from the dawn of history, in all parts of the world. We learn from the ancient Babylonian cylinders, bricks and tablets of clay, that the Accadians of old had libraries for their books of bricks, numbered and distributed to students by the librarian, that they made wills duly signed and sealed with thumb or signet, practised astrology, had "syllaberies" and grammars, as well as cribs and interlinear translations of the phonetic symbols and lists of ideograms. Their astronomers noted the weather, sun spots and eclipses, which did not always come off when predicted. Yet the Accadians had not developed grammatical gender, and were, if their records may be believed in the "mother-right" stage of social organisation. The woman was the head of the family, and ranked before the man, her name being always placed first in the records. The Assyrian Semites traced descent in the patriarchal line as we know, and, therefore, women held an inferior position. It is amusing to find that the Semitic translators of the Akkadian texts always carefully transferred the order of names, placing the man first, the woman after him. The mental phases of the language-makers are definitely stamped on language. To quote Dr. Abel once more, "Words mean what nations put into them," therefore "the introduction of one universal language would be far from ensuring uniformity of thought."

Modern English is compounded of words from almost every language on earth, and some have travelled very far and often. *Ayah* comes from Hindustani, one might think, but it is a Portuguese word *aia*, a dialectal variety of the Spanish *aya*, a nursery governess, and was carried to India by the Portuguese who discovered that country, and has since been brought back again by the English conquerors with a final *h* added. We have Anglicised the Polynesian word *tepu*, meaning sacred or forbidden, and transferred it, sense and sound combined, when we named "tabooed topics" or "tabooed luxuries." This is as much a proof of our intercourse with Polynesia as the Tahitanised English *buka buka*, which shews plainly who taught them to read. A man cannot ask for a glass of toddy without speaking Hindustani, and the old-fashioned pronunciation of "tay" comes nearer the Chinese ch'a than the modern enunciation of that familiar monosyllable. Chocolate comes from the Aztec chocolatl, so does tomatl, member of an extended group of native American languages characterised by the sound of "*tl*." We got our polka from the Bohemian Czech; tokay, like hussar, from Hungarian Magyar; and the sash of the ingénue from the *shest* or girdle of the Persian fire-worshippers. Cherub and seraph, with their learned plurals cherubim and seraphim, were trans-

ferred from the Hebrews, who derived them from the Assyrian Semites. Yet the former finds place in that familiar sea-song wherein Dibdin, with a total disregard of anatomy, wrote :—

> "There's a sweet little cherub that sits up aloft
> To keep watch for the life of poor Jack."

Some carry the genealogy of the cherub still farther back, and trace its origin in the ancient Egyptian word *Cherufu*. More words than are usually conceded may yet be proved of Coptic descent. Spanish is full of words of Arabic derivation, evidence of the Moorish co[illegible] Spain. When we transfer words from that Semitic tongue we run prefixed article and noun together, as in *el iksir*, "The elixir of life," *al kahal*, the strange source of alcohol, meaning a fine powder of black sulphide of antimony used to paint the eyebrows with. S[illegible] our words are compounded of two languages, like "inter-loper," which is half Dutch, half Latin, or, the Spencerian concept, "altruism," wherein the Greek suffix *ism* is joined on to the Italian word *altrui*, for another, while the "Data of Ethics" is derived from the Persian *data*, "settled," and the Greek *ethica*, "custom." Hence the philologist of the future will say with safety that English is a later linguistic produc[illegible] than Dutch, Latin, or Greek.

What mental phases are being revealed in the biographies and significance of words and titles. Our Sunday is a corruption of Sonsdag, and a reminder of the days of sun-worship. In Thursday or Thorsdag we preserve the memory of the worship of the thunder god, Thor, whom the Saxon Pagans of old formally renounced in the word, "Ec forsacho Thunare" on embracing Christianity. The significance of titles is rather amusing when looked into. The A.S. *aeldre* equals the Latin *senior*, French *seigneur*, *sieur*, our sir. Baron, M.E. *barund*, old English baron, *on* is a Norman suffix, in its older form *bar* means man, and in Provencal *lo bar* is "the man" and signifies a bearer, a porter, vassal, or servant. So that baron is no more than the equivalent of the familiar Scotch "mon" or the colloquial Spanish "Hombre." The German Graf comes from *der graue*, the grey one, and the English knight is the easier pronunciation of the German knecht, or servant. Our most familiar monosyllable to sell preserves a record of the days when salt was money, and a medium of exchange, as it is still in Central Africa. To buy is derived from the the A.S. *bycgan*, and goes back to the Icelandic *baugr*, meaning both money and ring, or twisted coils of gold, which were bended or broken off, to pay for what had been bought in the days when men carried their wealth on their person. It is said there are 250,000 words in the English language, all to be derived, Max Muller admits in his "Science of Thought," from the 800 roots, and every thought to the 121 simple fundamental concepts of Sanskrit. We have now reached the compounding epoch in language, and we have all the languages of the world, and the universal experiences of mankind to draw on. Sometimes these compounds betray the ignorance of the framers of them, as seal-fisheries and whale-fisheries, proof that they were put together by persons ignorant of the simple zoological truth that both whales and seals are warm-blooded mammals and not fishes, although they happen to live and swim in the water. How great is the extension of metaphor.

We speak of the flight of General Boulanger, yet, volatile as he is, he could scarcely fly without wings. With all this wealth of words in the English language it is said that 300 suffice to express the wants and feelings and ideas of the agricultural labourer, 3,000 are in general use, 12,000 are employed in the Bible, and 15,000 in all of Shakespeare's plays. Several hundreds have dropped out of use since he wrote them, or have so contracted or expanded their meaning that they would be understood in a different sense altogether. Crusade, for instance, once full of material significance—a long journey and a hand-to-hand fight—has now purely a metaphorical meaning. The changes that have marked the growth of our mother tongue during the last eleven hundred years are so important that, supposing that the spiritualists could raise the ghost of King Alfred, and he spoke in the Saxon of his day, not many of us would understand a word he uttered, nor could he comprehend us. The change is great indeed, only equalled by the development of new words and a multitude of slang expressions that corrupt Dan Chaucer's "well of English undefiled." The language of technicalities alone develops faster than most of us can keep up with it. Ten thousand new words, the product of the age, will be recorded in the "Century Dictionary," edited by the philologist Whitney, of Yale. Many of these technicalities creep into the literary language. We read now of political parties splitting, like slates, "along their lines of cleavage," of "the survival of the fittest" among politicians, and "the influence of the environment" in modifying their votes or opinions. Concepts like these and "natural selection," perhaps the most important concepts of our day, with names like Darwinists and Darwinism, will remain part and parcel of the English tongue so long as it endures. When we think of the genealogy of mere words, "antique gems of great value," of their power in recording the events of history and the discoveries of science, how they compel reforms and effect rovolutions, as we realize dimly all they can tell us of the past and all that they may reveal to the future, surely we should endeavour to use them wisely in an age characterised by more words than ideas. If speech be really the sole distinction between man and beast, it will be well to remember the words of one of the greatest masters of our English tongue :—

"'Tis not enough to speak, but to speak true."

Authorities—E. B. TYLOR—"Researches into the Early History of Mankind," "Primitive Culture," "Anthropology"; GARRICK MALLERY—"Pictographs of the North American Indians"; RICHARD OWEN—"Comparative Anatomy of Vertebrates," vol. 3; T. H. HUXLEY—"The Anatomy of Vertebrated Animals," "Man's Place in Nature," "Critiques and Addresses"; W. H. FLOWER—"Osteology of the Mammalia"; G. H. V. MEYER—"The Organs of Speech" (Inter. Sc. Series); W. D. WHITNEY—"Life and Growth of Language"; A. DE QUATREFUGES—"The Human Species"; KARL ABEL—"Linguistic Essays," "Slavic and Latin"; MAX MULLER—"Science of Language," (1 and 2 Series), "Chips and Chapters from a German Workshop," "Biographies of Words," "Science of Thought," "Hibbert Lectures"; A. H. SAYCE—"Introduction to the Science of Language," "Principles of Comparative Philology, 1885," "Assyrian Grammar,"

"Fresh Light from the Ancient Monuments, etc.; G. J. ROMANES—"Mental Evolution in Man—The Human Faculty"; BOYD DAWKINS—"Early Man in Britain," "Cave Hunting"; WAITZ—"Anthropology"; A. BAIN—"Logic"; W. SKEATS—"Etymological English Dictionary" and "Icelandic Dictionary." And the works of Mrs. ZELIA NUTTALL, HORATIO HALE, D. G. BRINTON, BLEEK, BRUGMAN, BOPP, DARWIN, HŒCKEL, LUBBOCK, GEORGE A. SMITH, RAWLINSON, BUDGE, WILKINSON, and other writers.

WEDNESDAY, MAY 15th, 1889.

BIRDS AND THEIR MIGRATIONS.

Rev. H. D. GORDON, M.A.

The birds of a country are its history written on wings, and sometimes the record is laid up in the rocks. M. Milne Edwardes thought that there was evidence to show that Madagascar and New Zealand were formerly united, since three species of Œpyornis found in Madagascar bore a close resemblance to the Moa or Dinornis of New Zealand, and to the Apteryxes, or wingless birds; just as the Emu, found in Australia alone, was the Cassiowary of south-east Africa. Wallace shewed that there were no indigenous mammals in New Zealand, the explanation probably being that the space intervening between Africa and New Zealand and Australia was submerged before the mammals had time to get down to the south latitudes. To this theory of separation and absence of mammalia, the birds of New Zealand bore their testimony, as there was a wonderful preponderance of wingless birds in New Zealand. In a country where there were no indigenous mammalia, and consequently few birds of prey, the species that habitually sought their food on the ground had no inducements to take wing, and, from long disuse, continued, perhaps, through countless generations, they lost their faculty of flight. Turning to another branch of the subject, Mr. Gordon said one of the most interesting facts relating to the birds of the world was the tendency to whiteness in the birds of New Zealand, and an opposite tendency, namely, to blackness, in the birds of India. Birds imported into New Zealand grew white. The law of assimilation of environment seemed to hold widely. The dark burnt spaces of the earth near the tropics would seem to favour darker races of birds and men, whilst the comparative absence of deeper colour in the north and the presence of snowy heights would seem to produce fairer haired men and fairer feathered birds. But an important variant in this matter was that the bird was less stationary than the man. In fact, all birds migrated to a certain extent, and within a circle of greater or less diameter. The flight lines of some birds were put at 10,000 miles,

and if allowance were made for head winds the distance was probably much greater even than that. Some birds vere not migratory, but simply wandered to and fro on the face of the waters. Thus the giant petrel had been known to follow a ship for three weeks. It often made 200 miles in the twenty-four hours, hunting up the wake of the vessel to secure any offal that had been thrown overboard, the interim being employed in scanning the ocean in immense circles. The most romantic migration known to us was that of the Pallas sand-grouse, from Central Asia and Siberia to England, some 3,000 miles due west. This took place in 1863, and was repeated again last year. It was, so to speak, an entirely original migration, for the lines of most birds were more or less north and south, whereas these came due west, and, though an inland bird, they exchanged the centre of the great Russian Asian Continent for the sea coasts of Western Europe. It was a matter of great satisfaction to find that the prediction that these birds would die out in 1889 had been falsified. Last week four were reported to him on the Downs, immediately south of our west corner of Snssex, going south, and in excellent health, and it was most probable that the migration of last year was still continuing, so that the passing of the special Act protecting the sand-grouse in December might be sufficient for success, though the penalty of £1 was not sufficient.

But Oceana had also some wonderful examples of migration, the startling suddenness of which almost paralleled the feat of the sand-grouse. Butler said that the Zosterops, or blight-bird, crossed Cook's Strait, for the first time within the memory of man, in the winter of 1856, coming over in numerous flocks as if to explore the country. Then it retired for two years and re-appeared in greater numbers than before in the winter of 1858, since which time it had been a permanent resident in the North Island, breeding in every district and becoming more plentiful every year. This migration was induced by scarcity of some food supply, which must have occurred again two years later. But the exceptional feature was that after the second migration the natural impulse to return home lost its influence. Every lover of beauty would echo the wish that the residence with us of that marvel of elegance, the sand-grouse, may be as permanent. Having cited Darwin's opinion that the cuckoo is parasitic, because she lays her eggs not daily, but at intervals of two or three days he added that a change of the female's plumage at nesting time indicated that the cuckoo once had a nest of her own. Mr. Gordon then said that having mentioned the great name of Darwin more than once, he should like to be permitted to quote the words of Sir Walter Buller, published last December in his magnificent reprint of the Birds of New Zealand :—"I see no difficulty in reconciling this view of the evolution of species by means of natural selection with the belief in the unity and design in Creation and with the acceptance of the great truths of revelation. It is not a question of the Creation itself as divinely revealed to man, but as to the plan and method of the Creation ; and when we understand by the 'six days' of the Mosaic record so many vastly extended geologic epochs every difficulty in the way of orthodox belief disappears. Science discloses the method of the world, Religion its cause, and there is no conflict between them except when either forgets its ignorance of what the other alone can know."

West Sussex was a most favoured area for rare bird visitors. Within the last two years we had had the Spoonbill and Hoopoe at Bosham, the Smew at Burton Park, the Ringed Guillemot at Westdean Wood, fourteen miles inland (marked by Gould as very rare at Plymouth where the common Guillemots are in plenty), and, the rarest of all rarities, a splendid kite was taken at Horsham. The lines which birds observe in migration had been called by the Americans "flight lines," a serviceable name. These invisible ærial railways were generally straight, especially when they were of great length. Sometimes these bird-railways cross each other at right angles. There was one crossing in Sussex, north to south being one path, and east to west another, but generally the bird flew straight and at great height. The first symptom of coming migration on the part of the common swallow was that the birds' flight over the meadow was no longer in semi-circles, but much straighter, in fact more like the swift's. For several years he had observed the straight line of migration maintained by the water wagtails, eminently a roadside bird, when they go due north in early spring. About the end of March to the third week in April our roads, which are straight north and south, are dotted with these charming birds, and when they reach us they stay some time under the Downs; but by the second week in May they have all gone up inland due north, by their Great Northern Railway. All birds breed in the coldest climate which they visit in their migrations, and Sussex was, generally speaking, too warm for the water-wagtail to breed in. The robin stayed in England to breed because England, the robin's coldest point, had the warmth of the Gulf Stream in certain places for the winter; the same birds could not winter in Germany, because it was too cold. The robin should have the welcome of a national bird in England; and the robin told us in spite of our groans, that an English winter is mild. As to the cross-roads, or birds' carfaxes, Mr. Seebohm described the Sussex Downs in autumn as a cross way between the soft-billed summer birds going, *via* Dover, south, and the hard-billed seed-eaters migrating due west, having crossed the German Ocean from Scandinavia possibly by way of Heligoland and now following the English coast line, and sending in small parties to winter in our mild climate. Here they had the cross line between the road south for the soft gentry, and the road west for the more robust; but each went straight on his line of march, like a bee out of a hive. And it was probable that the sandgrouse, once started west, went straight on occupying the same breadth of area with which he started in Asia, across Europe, to Britain, till the Atlantic stopped him, as it did the ancient Celts. Ornithologists now divided migrant birds into three groups—(1). Breeders in spring. and migrants in autumn to winter elsewhere, *e.g.*, cuckoo and swallow. (2). Winterers, going to better breeding grounds in spring, *e.g.*, fieldfare and widgeon. (3). Fitful comers, one month in spring and one in autumn, *e.g.*, little stint and dusky redshank, and here in Sussex might be added the ring ouzel. All these birds represented breeding in the north and wintering in the south. It was a rule without exception that each bird breeds in the coldest climate it reaches in its migration. Two other rules might be added to this:—(*a*) The further north a bird goes to breed in the

spring, the further south it goes to winter. (*b*) The other remarkable law was, that not one single land bird has been known to breed in the Southern Hemisphere and habitually winter in the Northern. Accidental visits of southern birds were doubtful evidence.

In order of migration, the early starters in autumn were birds in all stages of plumage,—old barren birds, odd birds that had been unable to find a mate, or birds whose nests had been destroyed too late in the season to allow them to make a second nest. Thus the instinct of migration was not checked by parental instinct. This premature migration had its uses; for when the period of migration of any species really begins, astounding as the fact was, it was nevertheless true that the birds of the year were the first to migrate, birds which had never migrated before. These birds had inherited from their parents an irresistible impulse to migrate, but no infallible knowledge of road. It might take them years to learn the various landmarks necessary to keep them from straying from the route: but they were doubtless led by some *avant couriers*. By the time that the birds of the year had left, roughly, a week, the males had finished their autumnal moult; and the second week of the migration of any species generally marked the passage of the males; most of the females migrated during the third week; whilst the fourth was devoted to the cripples, which came straggling in as best they might, in an almost ludicrous manner—birds which had lost one leg or some of their toes, birds with half a tail or a great hole in one wing, birds with one mandible abnormally long, or some other defect. In spring the order was slightly varied; the adult males came back first from Africa; then adult females, who were followed by the birds of the year. As in the autumn the cripples brought up the rear. Birds in migration often lost their way—taking the wrong turning, the wrong stream of migration, and made their appearance in our island as strangers from Siberia, Southern Europe, and not unfrequently North America, mostly birds of the year.

The object of his lecture, Mr. Gordon said, had been to show, however feebly, that every bird, when not necessary for the food of man, was worthy of its beautiful life, as a link in the Natural History of its chosen country,—evidence sometimes of transcendent value. Birds had been his humble life's companions, cheery, ethereal, devotional, sympathetic, for 25 years through many long thousands of miles of upland and dale, in some of the most lovely hills and vales of England; and he was only endeavouring to pay a lifelong debt in pleading for their life. No region of the earth was more favoured by the boldest and most resolute of birds than England. In the South of France, only 60 birds nest out of 350 species frequenting a cherished spot. In England probably quite 400 nest or would nest if we would let them. England ought to be a garden of birds, and would be if the Chinese or Turks or North American Indians inhabited it. But no English shrine had more hold on birds than Brighton. Brighton was consecrated by names of great lustre in ornithology—Gould, Booth, Swaysland, and many others, and by its world-famed Museums and Aquarium. And if birds mark the past history of a place, the wild birds still in their poetry and romance think that

Brighton is a country village, as the unique appearance of some of the warbler and bunting tribe in this neighbourhood shewed. Brighton was still to the birds the hill-side village of landing, with its easy approach to the Downs, and forest beyond. The higher bleaker shores of Kent from North to South Foreland were comparatively bare of migrational life. Where else in the world would they find a great city on the sea, where the nightingales, as at Brighton, April 13th, 1872, were swarming under the bathing machines along the whole length of the shore? In no age had birds been more idolised than in ours; every periodical shewed that they were in special favour: yet it was often the mock homage which killed its object. Those whom the gods and goddesses love die so young! It was sorrowful to see the noble birds of England, some of which had traversed 4,000 miles faithfully to re-visit their old nooks, wantonly, childishly massacred, to embellish a shop-front or a Christmas tree, or to adorn a lady's locks. Finally he pleaded for the Selborne Society—the object of which was to save the life of rare birds and plants, and the accessories of pleasant country life, footpaths and lanes and commons where the poor of the towns, after the day's work, might have their park close at hand, as the rich man had his broad acres; and to foster in public schools, of rich and poor alike, the humane study of Nature and reverence for all forms of God's great life, as a civilising and ennobling agent.

BRIGHTON AND SUSSEX NATURAL HISTORY AND PHILOSOPHICAL SOCIETY.

TREASURER'S ACCOUNT FOR THE YEAR ENDING 12th JUNE, 1889.

Dr.	£	s.	d.
To Balance in the hands of Treasurer, June, 1888	129	0	5
,, Annual Subscriptions and Arrears to 1st October, 1888	43	10	0
,, Annual Subscriptions to 1st October, 1889 ...	45	10	0
,, Entrance Fees	2	10	0
	£220	10	5
Balance in hands of Treasurer, 12th June, 1889...	148	10	6

	£	s.	d.	£	s.	d.
Amount in the hands of the late Collector, Annual Subscriptions and Arrears to 1st October, 1889, received by him	19	10	0			
Less Amount of Commission due to him	3	4	6			
				16	5	6

Cr.	£	s.	d.
By Books and Periodicals	7	9	1
,, Printing and Stationery...	16	9	3
,, Postages, &c.	8	12	11
,, Subscriptions to Societies	3	19	10
,, Commission to Collector for Subscriptions ...	2	2	6
,, Assistant Secretary's Salary	2	2	0
,, Gratuities to Assistants at Museum	2	10	0
,, Expense of Annual Excursion	3	16	2
,, Hire of Oxy-Hydrogen Lantern and other incidental Expenses of Meetings	1	7	6
,, Cost of Tea and Coffee at Meetings	1	4	5
,, Fire Insurance	0	12	0
,, Book Case	21	14	3
,, Balance in hands of Treasurer, 12th June, 1889	148	10	6
	£220	10	5

Examined with Books and Vouchers,

F. G. CLARK, F.C.A.,
56, Ship Street,
J. E. HASELWOOD,
} *Hon. Auditors.*

ANNUAL GENERAL MEETING,

JUNE 19th, 1889.

MR. J. E. HASELWOOD (PRESIDENT) IN THE CHAIR.

REPORT OF THE COUNCIL

FOR THE YEAR 1888-89.

Although the records of the Society during the past year do not present any feature of great interest there is one event which he Council cannot entirely pass over without remark. That vent is the dinner which took place at Markwell's Hotel, on the 23rd of November last, and the success of which fully justified the anticipations of those who suggested it. The meetings of the Society have been fairly well attended, though the Council would most earnestly wish that a larger number of members could be induced to take an active interest in the work of the Society. It is not too much to say that the papers read have been above the average in point of ability. Several, however, have been contributed by non-members. The meetings of the Society and the communications made to it have been as follows:—1888, October 10th, Inaugural address by the President (Mr. J. E. Haselwood), Twenty Years of the Society's History; November 14th, Colour Blindness, Mr. W. H. Rean, M.R.C.S.; December 12th, Microscopical meeting. 1889, January 9th, Nectaries and Nectariferous Glands, Mr. B. Lomax, F.L.S.; February 13th, the Localisation of the Functions of the Brain, Dr. W. Ainslie Hollis, F.R.C.P.; March 13th, the Origin of Speech, Miss Agnes Crane; March 27th, Special Meeting for the Discussion of Miss Crane's paper; April 10th, the Development of Language, Miss

A. Crane; May 15th, Birds and their Migrations, lecture by Rev. H. D. Gordon, M.A., in Central Schools, Church Street. Since the last annual meeting the Society has lost 23 ordinary members by death and resignation, and has acquired 10 new ones. It now numbers 169 ordinary and 7 honorary members. The annual excursion took place on the 10th of July last year to East Grinstead and was attended by about 20 members and their friends.

The Field Excursions have been as follows :—

1888

June 16—Buxted Park.
July 24—Crowborough Beacon.
Aug. 18—Glynde and Lewes.
Sept. 15—Shoreham and Steyning.

1889

May 18—Glynde and Lewes.

In accordance with our Rules and Regulations two gentlemen retire from the Council, viz., Mr. E. J. Petitfourt and Mr. E. S. Medcalf. To them the Society is much indebted for the attention they have given to its affairs and the activity they have displayed on its behalf.

The Reports of the Treasurer and Librarian will now be submitted to you and afterwards the names of those who, in accordance with our Rules and Regulations, have been nominated as the Council and Officers of the Society for the ensuing year.

LIBRARIAN'S REPORT.

During the past year the members of the Society have continued to use the Library as heretofore, though not so much as your Council would wish. There have been 106 books lent to the members during the year, while, at the same time, your Council are glad to be able to report that as a library of reference to the general public it has been much appreciated, and a large number of the books have been thus used. The following serials are taken in and may be had by the members on application :—

British Mosses, Annals of Botany, The Entomologist, Entomologists' Monthly Magazine, Geological Magazine, Geologist Association, Geological Society, Grevillea, Nature, Palæontographical Society's publications, Quekett Microscopical Club, Ray Society's publications, Royal Microscopical Society, Science Gossip, Zoologist.

There have during the year been presented to the Society the following books, and the best thanks of the Society are due to those ladies and gentlemen who have so kindly forwarded books to the Society :—

Cardiff Naturalist Society, Transactions 1888, Vol. xx., part 1, Report and Transactions, Vol. xx. part 2, 1888, two copies. Proceedings and Transactions of the Natural History Society of Glasgow, Vol. ii. (new series), Part 1, Vol. i. (new series), Part iii. Proceedings and Transactions of the Croydon Microscopical and Natural History Club, one volume. The Selborne Magazine for Lovers and Students of Living Nature, Elliot Stock, 62, Paternoster Row, E.C. Henry Willett, Esq., Arnold House, Brighton. Proceedings of the Geologists' Association, Vol x., Nos. 5 and 6. Quarterly Journal Geological Society, No. 177. Fossils of the British Islands, Vol. 1 Palæozoic) by R. Etheridge, 1888. Mrs. Wooldridge, Plants of New Zealand.

After the Reports had been read it was moved by MR. C. F. DENNET, seconded by REV. H. G. DAY, and resolved—

"That the Reports now brought in be received, adopted, entered on the minutes, and printed for circulation as usual.

It was moved by MR. G. DE PARIS, seconded by DR. E. McKELLAR, and resolved—

"That the Treasurer's account be submitted to the Auditors, examined by the Council and printed with the report."

It was moved by Mr. G. DE PARIS, seconded by Mr. C. A. WELLS, and resolved—

"That the following gentlemen be Officers of the Society for the ensuing year :—*President:* Mr. G. de Paris ; *Ordinary Members of Council:* Mr. E. J. T. Hart, M.R.C.S., Surgeon General J. J. Clarke. M.D., Surgeon General Dr. E. McKellar, Mr. W. H. Rean, M.R.C.S., Mr. H. Langton, M.R.C.S., Mr. J. Walter ; *Honorary Treasurer* : Mr. Thomas Glaisyer, 12, North Straet ; *Honorary Librarian* : Mr. D. E. Caush ; *Honorary Curator* : Mr. Beujamin Lomox, F.L.S. ; *Honorary Secretaries* : Mr. Edwd. Alloway Pankhurst, 12, Clifton Road, Mr. Jno. Col&atch Clark, 64, Middle Street.

Mr. H. HURST moved, MR. O. A. FOX seconded, and it was resolved—

"That the sincere thanks of the Society be given to the Vice Presidents, Treasurer, Council, Hon. Librarian, Hon Curator, and Hon. Secretaries for their services during the past year."

MR. W. H. REAN moved, MR. E. J. PETITFOURT seconded, and it was resolved—

"That the best thanks of the Society be given to Mr. J. E. Haselwood, now retiring from the office of President, for his attention to the interests of the Society during the past year."

The meeting was then resolved into an Ordinary Meeting, when Mr. A. Griffith, Mr. F. Merrifield and others, gave the result of their observations on the habits, &c., of some species of Lepidoptera.

SOCIETIES ASSOCIATED,

WITH WHICH THE SOCIETY EXCHANGES PUBLICATIONS,

And whose Presidents and Secretaries are *ex-officio* Members of the Society :—

Barrow Naturalists' Field Club.
Belfast Naturalists' Field Club.
Belfast Natural History and Philosophical Society.
Boston Society of Natural Science (Mass. U.S.A.).
Cardiff Naturalists' Society.
Chester Society of Natural Science.
Chichester and West Sussex Natural History Society.
Croydon Microscopical Society.
Department of the Interior, Washington, U.S.A.
Eastbourne Natural History Society.
Edinburgh Geological Society.
Epping Forest and County of Essex Naturalist Field Club.
Folkestone Natural History Society.
Geologists' Association.
Glasgow Natural History Society.
Glasgow Society of Field Naturalists.
Huddersfield Naturalist Society.
Leeds Naturalist Club.
Lewes and East Sussex Natural History Society.
Maidstone and Mid-Kent Natural History Society.
North Staffordshire Naturalists' Field Club.
Peabody Academy of Science, Salem, Mass., U.S.A.
Quekett Microscopical Club.
Royal Microscopical Society.
Royal Society.
Smithsonian Institution, Washington, U.S.A.
South London Microscopical and Natural History Club.
Société Belge de Microscopie, Bruxelles.
Tunbridge Wells Natural History and Antiquarian Society.
Watford Natural History Society.
Yorkshire Philosophical Society.

LIST OF MEMBERS

OF THE

Brighton & Sussex Natural History & Philosophical Society,

JUNE, 1889.

N.B.—Members are particularly requested to notify any change of address at once to Mr. J. C. Clark, 64, Middle Street, Brighton.

ORDINARY MEMBERS.

AYLEN, SAMUEL, 85, Western Road, Brighton.

ABBEY, HENRY, Fair Lee Villa, Kemp Town.

BROWN, J, H., 6, Cambridge Road, Hove.

BROWNE, GEORGE, M.R.C.S., 35, Montpelier Road, Brighton.

BADCOCK, LEWIS C., M.D., M.R.C.S., 38, Buckingham Place, Brighton.

BLACK, ARTHUR, B. SC., 77, Goldstone Villas, West Brighton.

BOXALL, W. P., J.P,, Belle Vue Hall, Kemp Town.

BALEAN, H., 15, Alexandra Villas, Brighton.

BOOTH, E., 70, East Street, Brighton.

BRINTON, ROBT., 20B., Middle Street, Brighton.

BLAKER, T. F. J., M.R.C.S., Wynnstay, Stanford Avenue, Preston Park.

BAKER, J. S., 38, Denmark Villas, West Brighton.

BABER, E. C., M.B., L.R.C.P., 97, Western road, Brighton.

BARROW, G. S. M.

BURROWS, W. SEYMOUR, B.A., M.R.C.S., 62, Old Steine, Brighton.

BARKER, G. D., 48, Western Road, Brighton.

BOUSTEAD SURGEON-MAJOR R., M.D., F.R.C.S.

BILLING, T., 86, King's Road, Brighton.

Clark, John Colbatch, 64, Middle Street, Brighton.

Cox, A. H., J.P., 35, Wellington Road, Brighton.

Champion, F. S., North Gate House, Church Street, Brighton.

Caush, D. E., 63, Grand Parade, Brighton.

Chapman, E., 34, Upper North Street, Brighton.

Coningham, W. J. C., 6, Lewes Crescent, Kemp Town.

Clark, F. G., 56, Ship Street, Brighton.

Cowell, Samuel, 143, North Street, Brighton.

Clarke, Surgeon-General J. J., M.D., 18, Vernon Terrace, Brighton.

Couchman, J. E., Down House, Hurstpierpoint.

Calvert, Rev. T., 15, Albany Villas, Hove.

Dennant, John, 1, Sillwood Road, Brighton.

Davey, Henry, J.P., 82, Grand Parade, Brighton.

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Brighton & Sussex Natural History and Philosophical Society.

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WEDNESDAY, OCTOBER 9TH, 1889.

INAUGURAL ADDRESS

BY

MR. GEORGE DE PARIS,

(PRESIDENT), ON

THE RELATION OF ART TO SCIENCE.

MR. GEORGE DE PARIS, by way of vindicating the action of the Society in choosing one who was not a Naturalist, but an Artist, set out to show the intimate connection which exists between the study of Art and the study of Natural History, and the great assistance which each can and should render the other. For instance (said the President) the delightful Field Excursions of this Society have made some of us familiar with the most romantic parts of Sussex. At many of those meetings Art has been well represented by both professional and amateur artists, who have amply illustrated the close connection of our varying pursuits. The rugged quarry which attracted the geologist, the tangled wood that gave employment to the botanist, and the quiet lake on whose banks and in whose reedy shallows the entomologist and the microscopist pursued their researches,—all offered subjects for the sketch-book of the Artist, and it was hard to say which of them had most enjoyed their short communion with Nature. Communion with Nature! That is the secret of our common brotherhood. The Artist may exercise his skill on the incidents of town life, or the excitement of a race-course; the Naturalist may pursue his researches in a city water-butt, but it is only in the company of Nature that their true studies are pursued. In the green lane, and on the breezy downs, they find their choicest wisdom, their purest happiness. And the saying of Grindon applies to the Artist as well as to the Naturalist, "Nature diligently and reverently studied, keeps the heart green, and carries on our youth far beyond the birthdays." And if the love of Nature in her most beautiful forms is common to the Artist and the Naturalist, they are still more closely united by their faculty for seeking out, and communicating to others, her most

recondite mysteries. As the student of Natural History finds in the stratification of a rock or the veining of a butterfly's wing a key to some hitherto unsuspected secret of the "Great Mother Earth," so the true Artist never traces the exquisite contour of a mountain range, or imitates the blending of the sunset's varying tints, without investigating, as far as in him lies, those hidden laws of harmony which make all Nature beautiful, and which he must himself skilfully apply, if he would transfer a portion of that beauty to his canvas. Nor does the resemblance stop here. The student of Nature must not merely investigate; he must generalise. The geologist who is seen to-day, lens in hand, examining the structure of some tiny fossil, will to-morrow unfold to us the nature and succession of the stratification of a continent, and the alternate depositions and denudations of centuries. The knowledge derived from the markings of a petal, or the peculiarities of a bird's claw, will enable the botanist or the ornithologist to trace the evolution of our household pets from long-extinct ancestors. So, too, the minute skill with which the Artist depicts the very form and colour of the objects before him, will be but labour in vain unless he has mastered the laws of composition, and knows how to combine the varied forms of beauty which are presented to his gaze into one harmonious whole. Such study is eternal. Nature is like the fabled Proteus: she must be held fast and bound with chains before she will answer the questions proposed to her; but she will answer them eventually. There is no mystery so great that the ardent student may not hope to solve or penetrate it, but the end is not yet. In the very solution of his problem another mystery comes into sight, "Hills peep o'er hills, and Alps on Alps arise." He feels like one of the Nile explorers—he has advanced a little further into the dark continent, but the vast interior is still unknown. Yet his progress is sure as far as he has reached, and he takes his place among the prophets; for, small though it may be, he has a revelation to impart and will leave the world wiser than it was before. Nor will I venture to decide which lessons are the more important, or the more durable,—those recorded with the pen, those traced with the pencil, or those chiselled on the monuments of remote antiquity.

Nor is it only in their common love of Nature, or in their endeavours to trace her hidden beauties, and to record them for the advantage of others, that the Naturalist and the Artist are brought into close connection. In both the faculty and close observation is largely developed, and the senses are quickened to a degree unattainable by those whom a similar enthusiasm has not "touched to fine issues." If the man of Science is prompt to mark some slight discoloration on a leaf, indicating the presence of a fungus, or some ripple on the still pond, telling where the

water vole has taken his refuge, the Artist is equally observant of each change of tint in the shifting clouds, each shadow cast upon the waving corn. No Naturalist is worthy of the name who allows the most trifling detail to escape his notice, and he is but an imperfectly cultivated Artist who cannot see in the most commonplace landscape a hundred beauties which are hidden from the untrained eye. It is possible that this delicate power of perception is a natural gift, which is afterwards strengthened by continual exercise. It is one of those numerous instances in which cause and effect seem to be reciprocal, the natural quality disposing its possessor to certain pursuits which in their turn develop the quality itself. This power of perception is not the only gift which the Artist and the Naturalist possess in common. Both inherit and cultivate a delicacy of manipulation which is, in fact, essential to the successful pursuit of their respective studies. An awkward painter, or a clumsy microscopist, would seem almost a contradiction in terms. It may not be out of place to mention here that the late Mr. Thomas Davidson, who took a very active part in the formation of the Town Museum, was a very skilful artist, having in his early years been a student at the Academy of Painting at Rome, and the training which he there received subsequently proved of inestimable value to him. In showing me one of his important works on Geology, he drew my attention, with pardonable pride and pleasure, to the illustrations the book contained, and to the minute lines and markings on some geological specimens and shells,—most significant in their revelation,—and assured me that only the trained eye could truly see or estimate the value of such apparently trivial or accidental lines, and on that account every illustration had been reproduced from his own drawings. Also, in a biography of the late Sir Henry Holland, the eminent physician, it is stated that all the illustrations in the medical works he published were from his own hand, and that he had constantly impressed upon medical students the value and necessity of the use of the pencil in portraying the intricate subtleties connected with every form of disease affecting our human nature.

But to revert to "The Relation of Art to Science," may I not define Art as chiefly skill in doing something which will produce a particular result; and Science as chiefly concerned with the investigation and knowledge of principles, chiefly founded on a knowledge of facts. Art, in fact, teaches us how to do something; and Science, if applied, explains why we must do it in that particular way. When the whole time and thoughts of men in early ages were occupied in supplying the necessaries of existence, there could be no Science; but when agriculture—itself for ages a mere art—afforded regular supplies, and more than enough to supply the immediate wants of hunger, then they

had leisure to think, and curiosity led to observation, and observation to inquiry, and inquiry to discovery, and this finally to theory. This gradual development proves that Art unquestionably preceded Science. Art was the result of trial and experiments; Science of observation and thought. Art brought into play dexterity and manual skill, whereas Science developed the powers of the intellect. Both are of paramount importance and value to man, and neither should be set before the other, but both should be encouraged and equally cultivated by all But in order to prove our case we must ask, which are the Arts to be considered and which the Sciences. The Arts have been classified as the "Primitive," the "Useful," and the "Fine Arts,"—this classification agreeing with their development; the Sciences into the "Abstract," and the "Applied," and those relating to whatever is material, and exists, as Geology or Botany. They may be, and have been, classified in several other ways, but that is a matter of little consequence in our present discussion; as we wish to show the relation of the Fine Arts to those branches of Science which treat chiefly of material things.

The Fine Arts are commonly said to be Painting, Sculpture, Architecture, Music, and Dancing. Of these five Arts, three are called the "Imitative Arts," namely, Painting, Sculpture, and Dancing, while Architecture and Music have been called "Creative Arts." Now, taking Painting as a convenient name for that style of Art which in any way represents scenes, objects, or actions, by delineation of form, and the effects of light and shadow upon a surface, all will probably admit the origin of this Art to be an instinct of our nature. We see it show itself in the rude sketches drawn by children, by the untutored savage, as on the tattooed bodies of the Maories of New Zealand. In a more advanced stage are the paintings of the Egyptians, who first recorded the remembrance of events by pictures representing them, and so, proceeding from suggesting ideas, which gradually developed the Art of creating symbols for sound, until those characters led up to the elements of sound, which we call letters. Thus alphabetic writing grew out of Pictorial Art, and it is a curious fact supporting this theory, that in ancient Greek the same word *Graphein* meant both to paint and to write. When language could be represented in this permanent form Science came into existence; for until the facts, observed or discovered, had accumulated and could be registered for the study and comparison of the philosopher, no real Science was possible—not even the science of language. The curious inscriptions to be found on the rocks of Mount Sinai, left by the ancient Israelites during their forty years' wandering, may be cited as a proof of the multiplicity of symbols required to express facts or ideas, until the power of writing was acquired, and superseded

that imperfect method of recording facts. The Rev. Charles Forster, who deciphered these symbols, published his discoveries many years ago in a most interesting work, called "The One Primæval Language"; and further information was subsequently afforded by the late Dean Stanley, who travelled over the same ground to verify the inscriptions, and strengthen the proof of the aid which Art has given to Science. But sometimes Science, if not the originator, is at least the great help-mate of Art. Of this, Sir Christopher Wren is a striking example. Originally he was a scientific man, and Professor of Mathematics at Oxford, but the happy combination of a mathematical and an artistic mind made him the greatest of English architects.

These instances serve to show the interdependence of Art and Science in one way. There is another aspect, however, in which we may consider them, namely, their effect in furthering the moral and intellectual improvement of mankind, and their separate and their joint influence on civilization. It has been said, "The object of the Fine Arts is to please," which at first sight might be considered an objection, and truly so, if they merely pleased an individual only. But the pleasure afforded by looking upon a beautiful scene, a fine picture, a noble statue, or by contemplating the grandeur of an imposing building, is not of a selfish kind, as it can be enjoyed by many simultaneously, for, as Keats has so well expressed it, "A thing of beauty is a joy for ever." Of this the ancient Greeks, with all their faults, were an instance. Their love of painting, statuary, and architecture, was one among the many circumstances which made them what they were, the most intellectual people the world of ancient times had produced. And this love of Art indirectly made them the students of Nature and of scientific investigation. The other great nation, the people of Rome, had not the same devotion to Art. The exhibitions of the circus had greater attractions for them, and brought out the brute force and athletic propensities of the populace, which made them the ruthless conquerors of antiquity, a people whose greatest pleasure was to witness the painful agonies of a dying gladiator or the cruel death of victims combating with the superior strength of devouring wild beasts.

It may be thought that I have spoken too much of the higher productions of the Fine Arts and their influence on the moral condition of mankind, but the influence of the higher productions of Art have a very powerful bearing on the subordinate branches of Natural History. On this point Professor Ruskin says, "Therefore the task of the painter, in his pursuit of ideal form, is to attain accurate knowledge, so far as may be in his power, of the peculiar virtues, duties, and characters of every species of being: down even to the stone, for there is an ideality of stones according to their kind, an ideality of granite and slate

and marble, and it is in the utmost and most exalted exhibition of such individual character, order, and use, that all ideality of Art exists. The more cautious he is in assigning the right species of moss to its favourite trunk, and the right kind of weed to its necessary stone; in marking the definite and characteristic leaf, blossom, seed, fracture, colour, and inward anatomy of everything, the more truly ideal his work becomes. All confusion of species, all careless rendering of character, all unnatural and arbitrary association are vulgar, and un-ideal in proportion to their degree." Of the material benefits which the Artist and the Naturalist can bestow on each other I need scarcely speak. To the researches of the Naturalist, Artists owe every pigment, varnish, and medium we possess, and we are always glad to learn from the botanist or the chemist how to mix them, so as to preserve them from destruction. The figure painter must of a necessity be more or less of an anatomist, and the landscape painter must study something of natural laws. This is amply proved by the fact that Ruskin's "Modern Painters," avowedly a treatise on Art, affords a considerable amount of information on various branches of Natural History. Nor does the disciple of Art fail to acquit himself of his acknowledged obligations to Science. The splendid treatises on every department of Natural History which are to be found in our library would be almost valueless to students were it not for the lifelike illustrations with which they are adorned; illustrations which not only reflect the highest credit on the imitative powers and skilled manipulation of the draughtsmen, but indicate an amount of acquaintance with the habits of the animals represented, that could only have been acquired by lengthened and careful study. But advantages of a higher though less tangible character cannot fail to result from a close companionship between the devotee of Art and the student of Nature. The ardent pursuit of any subject, however ennobling in itself, is apt to impart an exaggerated view of its importance, and a corresponding contempt for all other departments of study. Thus the Naturalist is apt to look upon the Artist as inexact and unpractical, while the Artist in turn is in danger of regarding scientific pursuits as of a grovelling character and destructive of lofty aspirations. Such prejudices do not stand the test of familiar companionship. The Artist learns from the Naturalist those lessons in precision and truth which he often needs, and imparts in turn views of harmony and environment, which frequently escape the more minute observer, while both acquire a higher consciousness of Nature considered as a whole.

To sum up. There is scarcely a science, if we except abstruse mathematical or metaphysical sciences, in which pictorial aid is not required. Even what has been called the greatest of all sciences—astronomy itself—has been largely indebted to the aid

of pictorial Art in its advancement, and the study of the heavenly bodies has been thereby placed within the comprehension of all classes, and therefore Art and Science have and ever will, jointly or separately, tend to the moral improvement, civilization, and consequent happiness of all mankind. I cannot better conclude this address than by mentioning that amongst the books which this Society has accumulated, there is one for which the Naturalist seldom thinks of asking, but which at first sight attracts the Artist. It is the Society's Album. There are to be found the counterfeit presentment of many who are dear to us now, and many more who were dear to us in past years. In the earlier part of that book are preserved some excellent sketches of places visited in former excursions, the work of hands, many of which have been cold for years. I am sorry that so few additions of the kind have been lately made. It is a sign that you have not so many artists and amateurs in your ranks as formerly. Such little "souvenirs" were valuable as recalling the memory of many a happy day, and their execution was not only an agreeable occupation to the draughtsman, but frequently afforded to his Naturalist companions a pleasure similar to that which he himself felt, when they displayed before his wondering eyes the marvels among which he had wandered so unconsciously. It will be a pleasure to me, as well as my duty, to contribute to the Society's Album during my year of office, and to enrich it with some records of the interesting spots we may visit, with the hope that other members will follow the example, and thereby amply illustrate the relation of Art to Science.

WEDNESDAY, NOVEMBER 13TH, 1889.

REMARKS ON THE LAWS OF NATURE,

BY

MR. W. E. C. NOURSE, F.R.C.S.

I. Every material substance exists and acts according to its own unchangeable conditions, named, for convenience sake, laws. The heavens and the earth, with all the things they contain, we often call Nature, the word signifying nothing more than the entire sum of material things around us. The phrase, Laws of Nature, merely means the separate conditions of existence and action

belonging to each thing; which conditions we group together in our minds and call by this name. The term Nature being thus applied to an assemblage of material things, it is unreasonable to personify Nature, as if it were some living being or independent power. Similarly, as the Laws of Nature merely mean the whole aggregate (in our own minds) of the particular laws of all substances, there appears not much sense in attributing to such laws a creating and regulating power. Still less rational does it appear to suppose that they form a conscious, discriminating, and independent power. In reality they have no associated existence, except in our own ideas. They are, in many respects, disconnected; they have no discrimination, and act as if blind. No substance or thing has the slightest power to change, or deviate from the conditions of its existence or action. It must inexorably follow the laws belonging to it. In the picture of material things thus presented to us, there is nothing that seems to assume rule or sovereignty over us. Such parts of it as we can reach and grasp, and comprehend the laws of, we can control and turn to our own purposes; and, provided we act in accordance with their laws, we can direct them one way or the other, just as our purpose or caprice may suggest. It thus appears that created matter can be, understood, guided, and employed, by intellectual power, and is so far, subject to the same. Human power and intellect can control such parts of the material universe as they are able to get at, but cannot deal with it as a whole. Man's ability does thus fall short, because of its numerous limitations; each person being only present at a time on one spot, from which his perceptions take place; his perceptions being able to reach certain distances only, and being unconscious of much that lies on both sides of their narrow range; the amount of his observing and thinking power being limited; and the time allotted to each person wherein to exercise his powers, being often curtailed by fatigue or infirmity, cramped in the first part of life by lack of development, dimmed in the latter part by organic decay, constantly interrupted by the daily need of sleep, and confined to a narrow span by the shortness of life. These disabilities are not inherent in the nature of things, but are only incidental to man. Hence, a being whose time is not cut short by death, nor interrupted by infirmity or sleep, whose perceptions are unlimited, whose intellectual powers are not bounded, and whom no circumstance cramps, will have perfect mastery over the universe, both as to understanding it, working by means of it, and controlling it, and will also be able to connect its workings in combinations or in sequences, that man is not able to put together and has but little means of tracing. A being possessed of such vast powers may reasonably be supposed to have other faculties of immense extent. Thus from mere material facts, from nothing more than what we learn, and can make out of the

physical phenomena of the universe, we obtain distinct indications of a possibility quite in accordance with those records which come to us as the word or revelation of God. It is when we turn away from the safe guidance of material facts, and look to the ideas and suppositions of men, that we find anything antagonistic to those records. The great history of human mistakes has yet to be written.

II. The importance of understanding the laws affecting all created beings and substances is very great, lest infraction of them lead to loss and death. These considerations pre-eminently apply to man himself, the most important animal of all. Man, the highest of organization, the most complex and delicate, subject therefore to laws and conditions equally complex is the most likely to suffer from infractions of those laws; and the consequences are with him more disastrous than in the case of any other creature. Every rational educated person, with 40 or 50 years' experience, knows how true all this is. For in that space of time, how many must he have seen whose lives were failures; some ruined in health by intemperance, by licentiousness, by unwholesome place or mode of living, by insufficient food, by mistaken management, by hurtful employments, by inherited disease, (the sins of the fathers being not seldom visited upon the children) or by causes not well known, – some ruined in mind, by passion, self-indulgence, or other means; some ruined in capacity for the occupations of life, by idleness, restlessness, pride, impatience, want of proper training, disorderly habits, or love of amusement; some ruined in reputation by vice, ill-temper, disregard to law, and to the rights of others, or by crime; some ruined in purse by extravagance, gambling, betting, speculation, or by being too idle or weak to manage their affairs properly; some ruined in person by accidents, injuries, diseases, or deformities; some ruined in an infinite variety of other ways. We have all noticed many such failures, such wasted lives, various both in kind and degree. One may compare the course of human life to a very narrow path surrounded with dangers mostly hidden, into which the slightest deviation either way makes us glide or fall. The dangers are wonderfully numerous: far beyond anything that young persons, or, indeed, many others, can be induced to credit. Certain conditions are required to ensure a good and prosperous life, and any breach of these conditions or laws invariably bring its exactly measured proportion of failure. Again and again is this observed to be verified. It comes true of our moral nature, of our intellectual powers, of our bodily strength and condition, of our health, and of our worldly position and means, and that without any exception.

III. In many aspects of Nature, we find suggestions of the

Infinite. Our scientific researches almost demonstrate the same, as they never seem to discover any limit to material things. The more we know, the wider and deeper appears the extent of the unknown. Our different instruments and apparatus for discovery disclose to us new things with every improvement. Thus it seems as if there were infinity in the material universe, and as if the only limitation were in our own perceptive powers, the possibilities of Nature being boundless.

IV. In looking at the general results of the operation of natural laws, we see, not confusion and chaos, but a certain order and system, although those laws act as if blind, and not with any discrimination or faculty of combining. That this should be so,—that order and system should thus result from undiscerning forces, points to the influence of some intention or purpose behind those forces and superior to them.

V. It is at or near the terrestrial surface, just where the atmosphere is in contact with the earth and sea, that organic life mainly exists and man can live. Here only, in this film of space enveloping the globe, have happened from remote ages, and still continue to happen, all the events and transactions of the human race --the famous deeds of history, and the common occurrences and doings of men throughout all time. Only here are these things possible. Here all the varieties of animal life, and all the plants and forests of the earth are found. Organic life is limited to this thin lower stratum of the atmosphere. Very little life exists above or below this line; and a certain distance above or below there appears to be none at all. Here alone the precise conditions are found which are needful for animal and vegetable life; and the said life, including that of ourselves, depends on such delicate and nice adjustments that any alteration would destroy it. A slight change would make this earth uninhabitable; yet the required conditions have been maintained, unchanged, for thousands of years.

VI. In contrast with the steady continuance of these nicely-balanced conditions, is that which we call perishable, but which is, really, changeable, in ourselves and in things around us. Yet even in the presence of these transient and fleeting forms, modern science has disclosed to us something in them which is imperishable and indestructible, resembling immortality in the midst of mortality. For both Matter and Force are, so far as we know, indestructible; but the present forms in which they both appear are evanescent and always changing. We ourselves have some power of changing their forms; but we cannot annihilate either matter or force. The impossibility of our destroying either, clearly implies a corresponding inability to create either. Both are out of our power. Yet, although to destroy any portion of

substance is to us impossible, there is no permanence in any material form. All is transient ; but there are extreme variations in the rate of change. The variations are so great that we suffer ourselves to believe in the permanence of some things, and the ephemeral nature of others. We speak of the everlasting hills, yet remark that " mortals pass away like flowers." Whereas we know that the hills are only everlasting in a comparative sense, and that the oldest rock-formations, and most durable substances, are still subject to destruction (that is to change of form) by erosion from air and water, heat and cold, from the growth of plants or the actions of animals, from chemical disintegration, from igneous action, or from mechanical force. We know also, that the lower the organisation the slower is the change ; but that in the more complex forms of matter change is rapid, and (other conditions being equal), most rapid of all in the most highly vitalised existences and tissues. During our whole life-time we see no change in the harder rocks and in precious stones ; we leave as we found them quartz and agate, greenstone, chalcedony, and the diamond ; in hills and mountains, cliffs and continents, any visible change is rare and exceptional ; and we have to go beyond our personal measure of time, and to turn to past records, to realise the universality of change in these comparatively durable things. But a day suffices to shew us the uncertainty of human life, the perishableness of all organic existences and of their parts and products, the fading of flowers, and the fall of " the contented leaves, that have done their summer work, and seem not afraid of dying." The rocks and pebbles disintegrate, the flowers fade, the grass perishes ; but the matter and the force belonging to them last and endure, and seem to us to be eternal

An attempt has thus been made to recount—

I. The invariableness of the Laws of Nature—their blind, undiscriminating action, with no regard to each other ; the impossibility of altering or resisting them ; and the practicability of adapting and guiding material things by working in accordance with their laws, to an extent measured by the greatness and duration of the power of the worker.

II. The practical success or failure of all human proceedings, each in exact proportion to the observance or disregard of the Laws of Nature that is used.

III. The apparent infinity of Nature.

IV. The continuous and durable order resulting from the Laws of Nature.

V. The small and thin surface all over the globe within which the conditions necessary for human and other organic life are alone found, the exact combination of those conditions, and their continuance without hurtful change for thousands of years.

VI. The perishableness of all forms and manifestations of Matter and Force, while the Matter and Force themselves can never be destroyed by any means yet known to man.

Many of us have been all our lives, lovers and observers of what is called Nature, that is, of the things of earth and sea and sky which surround us. Whatever details of them we have come to know appears to us more real, more true and actual, than anything else ; and when checked off, corrected, and amplified, by other observers, we feel them to be certainties. This kind of study must necessarily be carried on objectively, not subjectively ; by observation of outside things, not by thought or imagination within ; so that it is constantly fed by inexhaustible Nature, and has not to be sustained by internal effort or mental resource, which must sooner or later come to an end. But there is no time to enlarge on the great value of this kind of education. Probably we are only just beginning to understand its use, in promoting clearness and accuracy of mind, and in keeping us freer from intellectual error than most other modes of training ; because that which we study, and which is the subject or our attention, is, not the words and ideas of men, but the existence and life-history of the works of God.

WEDNESDAY, DECEMBER 4TH, 1889.

INSTINCT,

BY

MR. J. E. HASELWOOD.

Of the innumerable problems which Nature offers to her students, none seem to me more worthy of their careful study than that of Instinct. True it is that theologians and philosophers have settled the problem long ago, and to their entire satisfaction ; but, unfortunately, they have both proceeded upon insufficient data, or rather, upon no data at all, and, as a consequence, their conclusions are constantly being shown to be erroneous. The materials for a full and correct explanation of Instinct are at present very meagre, and, what is worse, many of them are untrustworthy. The unfortunate spirit of exaggeration into which so many fall vitiates one half of the stories on animal intelligence which we hear. When will people learn that exaggeration is the

worst form of lying? Your exaggerated account has just so much of truth mixed up in it as to make it acceptable, whilst its exaggeration utterly destroys its use for all scientific purposes. We want more facts, carefully observed, well considered, and accurately told, to help in this work. Everyone who keeps a dog, cat, bird, or any other animal, can assist, and to those who can give time and attention to what is daily going on in our noble Aquarium, a rich store of valuable information can be obtained.

An increased interest is added to the work by reason of its extreme difficulty. Our philosophers cogitate upon their own states and conditions, and they apply their reasonings to men like unto themselves. But we all know what a great variety of results they produce by their processes. How much more difficult must it be when we have animal nature outside Man to deal with. We can have but little idea as to what their states of consciousness may be. It seems clear that, as to some of them, their senses are very different in degree, if not in kind, to ours; there seems to be good ground for believing that, as to some, their sense of vision is not bounded by our spectrum, and that their sense of hearing is much more acute than ours; then again, we can only infer their states of consciousness from their actions, which we interpret much in the same way that we do human actions. We may be right, or we may be wrong, in this, but it is all we can do. You will say, if the difficulties are so great what is the use of troubling ourselves about the matter? It is just because it is difficult that the problem should be attacked. There is great encouragement for us in what has been achieved, and there is still more in the great advantages which may be attained by a fuller knowledge of animal life. We have many lessons yet to learn from what we are pleased to call the inferior creatures, not only in their wonderful intelligence but also in their extreme stupidity.

The only knowledge we get of animal action is derived from three sources, namely: reflex action, instinct, and reason; and before proceeding further it will be necessary to give definitions of what we mean by these three terms. It is true that in giving such definitions we almost beg the question at issue, but it seems that we can hardly avoid that if we are to treat the matter so that it can be understood. You must always remember that these definitions are only provisional, and used merely to make what follows easier to understand. In his work on Animal Intelligence, Romanes gives the following definitions of these three terms:—

Reflex action is non-mental, neuro-muscular, adjustment, due to the inherited mechanism of the nervous system, which is formed to respond to particular and oft-recurring stimuli, by giving rise to particular movements of an adaptive though not of an intentional kind.

Instinct is reflex action into which there is imported the element of consciousness. The term is, therefore, a generic one, comprising all those faculties of mind which are concerned in conscious and adaptive action, antecedent to individual experience, without necessary knowledge of the relation between means employed and ends attained, but similarly performed under similar and frequently recurring circumstances by all individuals of the same species.

Reason or intelligence is the faculty which is concerned in the intellectual adaptation of means to ends. It therefore implies the conscious knowledge of the relation between means employed and ends attained, and may be exercised in adaptation to circumstances, novel alike to the experience of the individual and to that of the species.

It follows from the above definition of Instinct that a stimulus which evokes a reflex action is at most a sensation, but a stimulus which evokes an instinctive action is a perception.

The most important point to observe is, that instinct involves mental operations. For this is the only point that serves to distinguish instinctive from reflex action. Reflex action is non-mental, neuro-muscular adaptation to appropriate stimuli; but instinctive action is this and something more. There is in it the element of mind. No doubt it is often difficult, or even impossible, to decide whether a given action implies the presence of the mind element; that is, conscious as distinguished from unconscious adaptation. But this is altogether a separate matter, and has nothing to do with the question of defining instinct in a manner which shall be formally exclusive, on the one hand, of reflex action, and on the other of reason. It is difficult, if not impossible, to draw the line between instinctive and reflex action. But at least the difficulty may be narrowed down to deciding in particular cases, whether or not action falls into this or that category of definitions. There is no reason why the difficulty should arise on account of any ambiguity of the definitions themselves.

Bearing in mind these definitions, we will now proceed to take some examples of instinct, and first we will take some cases in which the actions appear to be injurious to the actor either personally or relatively. The writer then gave several illustrations of these actions taken from the conduct of soldier termites, flesh-flies, sheep, and others, in addition to the following instances.

M. Fabre pierced a hole in the cell of a bee below the part where it was working and through which the honey at once began to exude. The poor, stupid little bee, however, never thought of repairing the breach. She worked on as if nothing had happened. In her alternate journeys she brought first mortar and then honey, which, however, ran out again as fast as it was poured

in. This experiment he repeated over and over again, with various modifications in detail, but always with the same result. It may be suggested that possibly the bee was unable to stop up a hole once formed, but that could not have been the case. M. Fabre took one of the pellets of mortar brought by the bee and successfully stopped the hole himself. The omission, therefore, was due, not to a want of power, but of intellect. But M. Fabre carried his experiment still further. Perhaps the bee had not noticed the injury. He chose, therefore, a cell which was only just begun, and contained very little honey. In this he made a comparatively large hole. The bee returned with a supply of honey, and, seeming much surprised to find the hole in the bottom of the cell, examined it carefully, felt it with her antennæ, and even pushed them through it. Did she, then, as might naturally have been expected, stop it up? Not a bit. The unexpected catastrophe transcended the range of her intellect, and she calmly proceeded to pour into this vessel load after load of honey, which of course ran out of the bottom as fast as she poured it in at the top. All the afternoon she laboured at this fruitless task, and began again undiscouraged the next morning. At length, when she had brought the usual complement of honey, she laid her egg, and gravely sealed up the empty cell.

These cases of mistaken action might be multiplied to an unlimited extent, but my object is attained when I call your attention to the fact, and by so doing lead you to look into the matter fer yourselves, and thus verify the somewhat important statement that insects and animals may display a marvellous degree of stupidity in the exercise of their so-called instincts, and that many of these instincts have by no means the sure and certain modes of action which is usually claimed for them.

Mr. Haselwood then gave two or three cases of actions which do not accomplish the object which appears to be in view; and amonst them the following example:—

One species of Sphex preys on a large grasshopper. Having disabled her victim, she drags it along by one of the antennæ, and M. Fabre found that if the antennæ be cut off close to the head, the sphex, after trying in vain to get a grip, gives the matter up as a bad job, and leaves her victim in despair, without ever thinking of dragging it by one of its legs. Again, when a sphex had provisioned her cell, laid her egg, and was about to close it up, M. Fabre drove her away, and took out both the grasshopper and the egg. He then allowed the sphex to return. She went down into the empty cell, and though she must have known that the grasshopper and the egg were no longer there, yet she proceeded calmly to stop up the orifice, just as if nothing had happened.

Next followed some cases of actions which sometimes do and

sometimes do not accomplish their object, and amongst them the following examples :—

M. Fabre took ten bees, marked them on the back with a spot of white and put them in a bag. He then carried them half a kilometre in one direction, stopping at a point where an old cross stands by the wayside, and whirled the bag rapidly round his head ; he then started off back in the opposite direction, and carried his prisoners to a distance from their home of three kilometres ; here he again whirled them round, and then let them go one by one. They made one or two turns round him, and then flew off in the direction of home. In the meantime his daughter Antonia was on the watch. The first bee did the mile and three quarters in a quarter of an hour ; some hours afterwards two more returned ; the other seven did not reappear. He tried five other experiments, with the result that out of 144 bees, 47 found their way home and the others did not.

The writer then gave some examples of actions which appear to be perfect, instancing amongst others the following :—The Ammophila (a solitary wasp) having built her cell, places in it, as food for her young, the full grown caterpillar of a moth, Noctua Segetum. Now if the caterpillar were uninjured, it would struggle to escape, and almost inevitably destroy the egg ; nor would it permit itself to be eaten. On the other hand, if it were killed, it would decay and soon become unfit for food. The wasp, however, avoids both horns of the dilemma. Having found her prey, she pierces with her sting the membrane between the head and the first segment of the body, thus nearly disabling the caterpillar, and then proceeds to inflict eight more wounds between the following segments, lastly crushing the head, and thus completely paralyzing her victim, but not actually killing it, so that it lies helpless and motionless, but, though living, let us hope insensible. The spots selected are exactly those occupied by the ganglia, no others among the innumerable points which might have been chosen would have answered the purpose ; not one wound is misplaced or without effect.

Eumenes (another wasp) like Ammophila, stores up the victims once for all ; they are grievously wounded, but not altogether paralyzed. The wretched caterpillars lie in a wriggling mass at the bottom of the cell ; a clear space is left above them, and in this space from the summit of the cell, the delicate egg of the wasp is suspended by a fine thread, so that, even if touched by a caterpillar in one of its convulsive struggles, it would simply swing away in safety. When the young grub is hatched, it suspends itself to this thread by a silken sheath, in which it hangs head downwards over its victims. Does one of them struggle : quick as lightning it retreats up the sheath out of harm's way.

In dealing with the actions of living creatures it must not be forgotten that individuals of the same species often differ very materially in their intellectual powers. The familiar example of human beings may safely be carried downwards all through the lower stages of life. Some remarkable evidences of this will be found in examining experiments with bees. It does not follow that, because we find one animal doing a stupid thing, therefore all the animals of that species will show the like want of intelligence. On the contrary, we do find, in many cases, and may expect, on further experience, to find in all a gradation of intelligence from almost entire absence to a very remarkable amount of ingenuity. We cannot, however, but be struck with the large amount of what appears to us to be gross stupidity, and some examples of which I have given you, and all of which rnn so counter to the popular conception of instinct. On the other hand, we find innumerable examples of the self-sacrificing virtues, especially in devotion to the young as well as in other forms.

The ethics of the animal economy is a large and difficult question, and I have no intention of entering upon it here further than calling attention to that aspect of the matter. It is well worthy of careful study. For my part, I have seen no satisfactory solution of the question. To me it seems very difficult to deal with the case I have quoted of the wasp Eumenes. It seems shocking that a mass of caterpillars should be kept alive, only just sufficiently injured to prevent them escaping or injuring the young grub, and then to be gradually eaten up alive. However low the nervous system of the caterpillars may be, it seems impossible to get away from the conviction that there is much suffering endured.

In his article on Instinct in the Encyclopedia Brittannica, Romanes says, "Instincts probably arose in one or other of two ways." First, by the effect of habit in successive generations, mental activities which were originally intelligent become, as it were, stereotyped into permanent instincts ; secondly, by natural selection, or survival of the fittest, continuously preserving actions which, although never intelligent, yet happens to have been of benefit to the animals which first chanced to perform them ; or, thirdly, the two blended. And that "Instincts are not immutably fixed, but on the contrary, are eminently variable."

I need scarcely say that this paper is, to a large extent, a compilation from the works of Romanes, Lubbock, and Buchner. The only merit I can claim (if merit there be) is the putting of it together and calling your attention to a subject upon which I find most men's minds are made up, but unfortunately in a manner quite contrary to the facts, so far as those facts are at present ascertained. In this case, as in so many others, the Iconoclast has first to break down the idols and make a clear space for unprejudiced investigation. Then the beginnings of real knowledge make their

appearance and gradually extend until mankind come to doubt whether they ever held the erroneous belief at all. I hope it may be so with Instinct. At present little has been done. It is true sufficient has been done to show that the old belief was wrong, but much more requires to be done before the Naturalist will be satisfied to frame a definition of Instinct, and in this work many of us can help by careful experiments, and equally careful observations, with the certainty that in carrying them out we shall be sure to learn many things interesting to ourselves, and useful to our fellow creatures.

WEDNESDAY, JANUARY 8TH, 1890.

EVENING FOR SPECIMENS.

Among the specimens exhibited were two meteorites, by Mr. E. A. Pankhurst (one from India and one from North America), and some skulls and sketetons of crocodiles from the Museum. With reference to these last, Mr. E. C. Crane, F.G.S., made the following remarks :—

The structure of the skeleton in the living crocodile has undergone various modifications, possibly resulting from the great physical changes in the environment which have occurred in the earth's history since their early ancestors, *Stagonolepis* and *Beledon* appeared in the upper Triassic rocks. The differentiation of this great reptilian tribe had advanced but slightly during that epoch. These Triassic crocodiles had many singular characters ; neither the palatine nor pterygoid bones were formed into osseous plates. In later forms these are prolonged into the nasal passages and give rise to the secondary nares. Therefore, the nasal chambers communicate with the mouth by openings placed beneath the anterior part of the skull. The upper and lower parts of the body were encased in a close-fitting bony scutal armature. The pre-maxillaries of the Triassic *Beledon* were very long, resembling those of *Ichthyosaurus* and the living cetacean—the dolphin. Both these crocodiles had the vertebræ cupped at each end, and presented affinities of structure with the extinct lacertilia of the Permian and Carboniferous Rocks and the living *Sphenodon* of New Zealand. A great gap occurs at the close of the upper Triassic epoch. No crocodilian remains are known at present from lower Liassic deposits, but in the upper Lias of Whitby

numerous remains of teleosaurians have been discovered, being well adapted for aquatic life, with their long jaws, sharp-pointed teeth, and bi-concave vertebræ best fitted to pursue and seize slippery prey like fishes. In form, these reptiles differed but little from the modern gavials, having a similar long, slender snout and sharp-pointed teeth. The fore-limbs were much smaller than the hinder ones. The vertebræ were bi-concave, and the upper and under sides of the body encased in armour as a protection against the large contemporary carnivorous marine *Ichthyosaurii* and other forms. The opening of the posterior nares upon the palate is not so near the snout as in the Triassic genera and the external nostril has but one aperture. In the middle Purbeck beds of the later Mesozoic epoch, dwarf crocodiles have been discovered, and were subsequently described by Professor Sir Richard Owen, one under the name *Brachydectes*, or short biter, owing to the fact that only one third of the alveolar border is provided with teeth, the hinder part being edentulous. The other *Theriosuchus* is better known from a well-preserved skull and nearly complete skeleton. It appears it rarely attained a length of more than eighteen inches when adult. Other remarkable features characterise these dwarf crocodiles and *Goniopholis* from the Wealden deposits. The posterior nares were placed further back on the palate; the skull is broader, and the centres of the vertebræ are not so concave as in the earlier species, but are nearly flat. The armature was also different. The dorsal scutes had a peg which fitted into a groove of the succeeding scute; the ventral scutes were firmly joined together by broad scutral borders. A similar structure is characteristic of the large bony enamelled scales of many of the ganoid fishes, among which we may name the American gar-pike (*Lepidosteus*). Seven specimens of this genus, thanks to Colonel Marshall McDonald, U.S. Fish Commissioner, can now be seen alive in tank fifteen of the Brighton Aquarium. In the middle Mesozoic, from the Stonesfield slate, at the base of the Great Oolite to the close of the Cretaceous, many more genera and species of mammalia made their appearance, ranging in size from a mole to a pole-cat. The later middle Purbeck beds of Durdleston Bay have yielded twelve other species, and in the upper Cretaceous of Dakota and Wyoming, U.S.A., Professor O. C. Marsh has quite lately discovered about 100 specimens representing many species, varying in size from a mouse to an opossum. This increase in the mammalian fauna affording a change of diet and necessitating increased activity in pursuit of these small mammals might have promoted variations in the form of the vertebræ and the further backward prolongation of the posterior nares in the Purbeck, Wealden, and upper Cretaceous crocodilia.

A great break occurs at the close of the Wealden deposits.

No crocodilian remains are known at present from the lowest Cretaceous series. But the upper Greensand of New Jersey, U.S.A., has yielded *Hyposaurus* with bi-concave vertebræ and two genera *Thoracosaurus* and *Hylops* with procælian characters. In Europe *Gavialis macrorhynchus* from the upper chalk of Maestricht differs very little from the recent species and thus foreshadows the existing crocodilia.

In the succeeding Tertiary Rocks numerous remains of fossil crocodilia have been discovered in the earliest Eocene deposits of England and the continent of Europe, differing very slightly from existing species. But there is a most remarkable feature in these deposits. Gavials, alligators, and crocodiles are often found associated together, whereas to-day all three of them occur widely separated in various parts of the world. In the London and Hampshire basins one gavial, two crocodiles, and one alligator have been found, and in this County the Bracklesham beds contained several species of crocodilia. These later species as well as the now living forms have undergone a great change, especially in the vertebral column. Each component vertebra, instead of being cupped at both ends as found in the earliest of the crocodilia, had a cup-and-a-ball structure. The defensive armour has also degenerated, bony ventral scutes are exceptional and the dorsal ones fewer and thinner, not so closely arranged nor so firmly connected together, therefore adding less weight to the body. *Crocodilus Hastingsiæ* from the middle Eocene of Hordwell Cliff, Hampshire, had a peculiar dentition, half alligator and part crocodile, and a closer fitting armour than its contemporaries, resembling in that respect the South American caimans and jacares, the only two living species of alligators possessing bony ventral scutes as well as dorsal ones. But neither of the above-named species, nor any warrior of olden times, equalled the armature of the extinct *Goniopholis crassidens* of the Wealden, with its peg and groove tight-fitting cuirass.

All the large carnivorous reptilia, *Ichthyosaurii Mososaurii*, and other large genera became extinct at the close of the Cretaceous period, so the crocodilia existing at that time would have no powerful enemies to contend with. There was a concurrent diminution in the thickness of the dermal armour. As previously noticed, the vertebral column in all crocodilia prior to the upper Cretaceous was composed of bi-concave vertebræ. In the upper Cretaceous the cup-and-ball modification first appeared and ultimately prevailed. All existing crocodilia have the procelian character. This strengthening of the vertebræ undoubtedly facilitated the progression of the reptiles on land in pursuit of the numerous forms of warm-blooded animals which made their appearance towards the close of the Cretaceous, and in the earliest Eocene period had increased in size and become very abundant.

WEDNESDAY, FEBRUARY 5TH, 1890.

MR. H. DAVEY, JUNIOR,

ON

THE EVOLUTION OF MUSIC.

Developed Music may be roughly grouped into three divisions: Pure Vocal Music, Accompanied Vocal Music, and Pure Instrumental Music. The first to develop, pure vocal music, lasted down to the year 1600, when it was displaced by the other two. Accompanied vocal music reached its climax between the years 1725 and 1750; pure instrumental music not until the present century. As no satisfactory definition of music had ever been given, he offered, as the best he could invent, "Music is the judicious use of the phenomena of sound," and he undertook to prove that its evolution had consisted in the transformation of the homogeneous into the heterogeneous, that it had undergone the differentiations, integrations, and (in the first great division of the Art) even the equilibration, which, according to Herbert Spencer, are the successive stages of evolution. It is known (he proceeded) that sound is produced by vibrations, conveyed by the air to the drum of the ear, and thence to the brain. At about 30 vibrations a second, sound becomes audible; this is about the rate of vibration of the longest string of a pianoforte; the shortest string of a pianoforte vibrates as many as 4,000 times a second. Notes may be heard beyond these limits, but they are not very clear. Herbert Spencer, in a well-known essay, and Tylor, in his *Anthropology*, both derive music from emotionalised language. This is questionable. At any rate, the most rudimentary forms of music now known seem a direct imitation of the song of birds. It is practically certain that the advancement of musical skill must have affected the hearing apparatus. In the labyrinth of the ear Corti discovered that there are some 3,000 fibres, and without doubt these are imperfect in some ears, and sharply defined and separated in others. The power of recognising a tune is the lowest form of the sense of tone; and this power is posssessed by some of the lower animals, as by horses and birds, but seems very deficient in some of the human race. Something too much has been talked of the heredity of the musical talent, even by Spencer in the *Principles of Biology*, for there have been cases where a musician of the very highest gifts suddenly appeared in a quite unmusical family, but no doubt the rule holds good in general.

In all savage and half-civilised nations we find a great delight in pure sounds, and especially in rhythm. The Lecturer expressed his dissent from the views of Herbert Spencer, who regards the origin of music as purely vocal, and omits all reference to the rude instruments which must have preceded that systematising of emotionalised speech which, in Mr. Spencer's opinion, was the origin of music. The most barbarous savages accompany their orgies with anything that will make a noise ; and this use of the phenomena of sound in essentials remains the same to this day in the East and in Africa, the only other use being to give signals in war. Neither the Orientals nor the ancient Greeks ever produced anything important in music, the reason being that music was by them associated with either dancing or poetry, and not allowed to exert its own powers. This did not happen until the invention of harmony. We shall never know how and when harmony came into favour, but it was known in all the north-west of Europe one thousand years ago. About the same time the use of signs written on a line, above and beneath the line, had been used to determine notes, and the advantages were so obvious that other lines were added, and the present notation came into use. The importance of having a special notation for music, instead of using letters of the alphabet as the Greeks did, must not be underrated.

Before the year 1100, at Paris, a number of musicians are known to have used the devices technically called Counterpoint and Imitation, which served to differentiate pure vocal music as a special branch of the Art. The famous Reading Rota, a piece for six voices written in the year 1226, is a great landmark in the history of music. On mentioning this, Mr. Davey paused to show by actual illustrations the difference between embryotic music and the development reached in the 13th century. He sang a number of African airs, one of which consisted of only two notes, and others of only three. Savage and half-civilised nations find a great delight in repeating one of these phrases for hours together, exactly as birds do. This peculiarity may be traced even in our own music, for very popular melodies repeat the same note several times.

Among civilised Asiatic nations music assumes a somewhat different character. The Chinese and Hindoos both have an ancient system of music, very ugly and out of tune to us, as ours is to them. But there is one part of Asia, where, more than 2,000 years ago, music took a different form, which has had a very great share in the development of the Art to its present lofty standard. The chants sung in the temple services of the Jews contained a kernel of inner strength and purity upon which foundation a vast structure could be erected, as the event has proved. Their style of chanting afterwards passed into the ritual of the Christian religion, and the long-held notes proved, after the use of harmony, extremely favourable for the construction of elaborate pieces of

sacred music. In their most primitive form these chants are still sung in the synagogues, and it is worthy of note that the Mahometans read the Koran to fixed intonations which strongly resemble some of the ancient Hebrew melodies. Yet, however, the Semitic nations had not discovered harmony, and could not use the resources they had, any more than the Greeks could.

It is very unfortunate that almost nothing is known of what Greek music really was. The modern Greeks use no harmony, and their music is allied to the Oriental.

That was the state of the Art of music 1,000 years ago. In Africa and Asia it has remained the same to this day, a simple delight in hearing and producing sound. But a change took place in North-Western Europe, which was destined to raise music to a height at least equal with the other Arts. The invention of harmony was the special dividing-line, but it was only one of three great means by which existing resources were applied to the construction of pieces of music, making it possible to include intellectual and psychological features. Besides harmony, and afterwards imitation, there were the faint beginnings of design, which consists of contrasting entire sections of a piece of music. This necessitated increased musical memory in the auditor. Its origin is unmistakeable. It was a new element in poetry that brought this new element into music. The northern nations invented rhyming poetry, through which their ballads acquired a parallelism of line quite unlike the ancient verse. This naturally suggested a parallelism of music; if the first and third lines of a stanza rhymed, it was natural to sing the first and third lines to the same or at any rate similar music; thus the idea of contrasting sections no doubt took its origin.

A lament on the death of Charlemagne (814 A.D.), and a tune composed by the King of Navarre (13th century) were sung to show the difference between music at the beginning of the period of development of rhyme and musical rhythm, and the state of the Art 400 years later. The latter song was analysed, and shown to consist of repeated sections, which were used to construct a tune. The Rota from Reading Abbey is something still higher, a tune being used for the construction of the piece.

It was next shown how it became possible to introduce intellectual and psychological features into music. The pure vocal music of this period was often disfigured by the trick of making each voice sing different words, and it seems to have been thought a particularly clever thing to contrast the most sacred and the most vulgar words. Thus there appeared a new feature, for the treatment of both words and music had a share in the humorous effect. It was originally simply irreverent wit, and was forbidden by the Council of Trent; but the "associative

idea," as it may be termed, remained, and has been turned to very great account.

The psychological features in music first became prominent in the middle of the 16th century, when Palestrina, Orlandus Lassus, and their English contemporaries attempted to produce compositions which should arouse feelings in harmony with the words set. This produced a culminating epoch of ecclesiastical and madrigal music which has been unsurpassed even to the present day. The older style of pure vocal composition had thus passed through the stages of differentiation from other arts, of integration in itself, and finally of equilibration. It had completed the round of its evolution, being transformed from the perfectly homogeneous, such as was shown in the African repetitions, up to the heterogeneous, bound into a complete entirety by the resources of melody, harmony, design, and rhythm, and affording the psychological interest of an expression in concordance with the words, and exactly suited for the means at command for its performance. It had thus reached a point which may be called perfection, when any change could only be for the worse. The change it did undergo was a very rapid decay and the complete equilibration, death, which was hastened by external circumstances.

Pure instrumental music first appeared not long before the equilibration of pure vocal music ; at first they were not differentiated. The English madrigals were published as "apt for viols and voices," that is, they were equally intended to be sung or played. The dance music was also sung or played. The organ was used to assist the voices in the churches ; it had no independent music. But in the 16th century the idea of instrumental variations on a tune grew familiar, and there are also cases of illustrative music, in which the associative interest already alluded to is employed. Some attempts to depict battles and thunderstorms were made. Since it is possible to produce notes very much more rapidly upon instruments than upon voices, instrumental music is specially distinguished by its multiplicity of notes, and throughout the 17th century there was a continuous progress in execution, accompanied by great improvements in the violin and the keyed instruments. Also the rapidity of execution upon instruments began to be emulated by voices, and the powers of both coalesced in forming extensive works, to understand which it is necessary to look again at vocal music.

The dividing line between the mediæval and modern schools of composition may conveniently, and with tolerable accuracy, be drawn in the year 1600. The unaccompanied vocal music then gave way to solo songs with instrumental accompaniment and dramatic declamation. This new style, invented at Florence, exaggerated the intellectual interest, and neglected beautiful

sound and all the merits of the preceding period. Its special gain was the introduction of new harmonies, the chord of the seventh being made familiar by Monteverde, which enormously increased the means for the suggestion of strong passion. The accompanied recitatives, airs, and choruses of the later 17th century, with the addition of instrumental interludes, were integrated into great works lasting for two or three hours. The oratorios of Handel, and the Passions, Masses, and Cantatas of Bach, brought the form of accompanied vocal music to its climax, and it became equilibrated, ceasing to develop farther.

The evolution of pure instrumental music was described as the most wonderful and interesting of all. As already mentioned, it was differentiated from vocal music by the year 1600. It integrated into various forms, some of which are a close imitation of the vocal song and the vocal fugue; but the Fantasia and the Sonata or Symphony are purely instrumental. Considerable attention was given to the latter form; the rhythmical contrasts in which the great masters of the Sonata excelled were illustrated by examples from Haydn, Mozart, and Beethoven; and were compared with the homogeneity of early tunes, where nearly all the notes are the same length. How homogeneity became hetereogenity, as regards power of tone, was shown by a contrast of Handel's simple methods with the continual gradation and shading indicated by later composers; and also by the fact that a beginner on the pianoforte plays every note with exactly the same strength; as he improves he first learns to differentiate the melody from the accompaniment, making the performance heterogeneous, and the heterogeneity continually increases as the performer's skill develops up to the subtle gradations and the prodigious sudden contrasts of the very greatest pianists. Mr. Davey also made some remarks upon equal temperament, which extends key-relationship, by which all the factors of the Sonata are welded into one connected whole; and upon modulation, which enables a variety of scales to be used in a composition.

A glance was also taken at the lyrical sentiment developed in this century, and at the last resource of importance brought into music, the Leit-Motif, a succession of notes labelled with a title, and employed by Berlioz and Wagner much in the same way as a known proposition is employed in a mathematical demonstration. Then, speaking of his original proposition as proved, Mr. Davey discussed the theories of Helmholtz concerning temperament and the chords which have the best effect; and said that the great physicist had not realised that music consists of successions of sounds, and not of isolated chords, and depends on a great many other things besides beauty of sound. Mr. Davey played a portion of a piece by Alkan, using close harmonies at the bottom of the pianoforte, which, according to Helmholtz, would be the worst

thing possible; yet, though the acoustic effect is detestable, the musical effect is admirable, because it is intended to suggest the moaning of the sea, and succeeds in doing it.

The height to which the musical faculty has been brought was illustrated by the feats of memory common among musicians, especially among pianists. In Spencer's *Principles of Psychology*, it is truly said that "The clearest instance of the gradual lapse of memory into automatic coherence is yielded by the musician." That a pianist should be able to play a series of entire programmes by heart, may be claimed as, in the direction of memory, the greatest achievement of man.

WEDNESDAY, MARCH 5TH, 1890.

MR. W. H. REAN, M.R.C.S.,

ON

THE OPTICS OF THE EYE.

WEDNESDAY, APRIL 2ND, 1890.

MR. E. C. CRANE, F.G.S.,

ON

SPHENODON AND ITS AFFINITIES.

Among the most noteworthy of the recent additions to the Brighton Museum purchased by means of the Clericetti bequest, are the stuffed specimen and skeleton of the Sphenodon. This curious little lizard has become nearly extinct on the main land of New Zealand, chiefly owing to the introduction of pigs by the colonists. These animals devour them, and they are also killed by the natives for food; but they are still to be found on the small islands off the coast in the Bay of Plenty, and are quite harmless, never attempting to bite or resist when captured. The structure of the skull presents some remarkable characters; the quadrate bone is united sutrally and is immovably fixed to the skull. It has a complete orbital ring and an expanded columella. The bottom of the orbit is entirely ossified. The frontal bones are united by a distinct suture, a groove running along their lower edge for the reception of the olfactory nerve. The roof of the palate is almost continuous. The eyes are surrounded with sclerotic plates similar to those of the *Ichthyosaurus*, and of some birds and fishes. In no other reptile do the skull and pectoral arch present so many similar features to those found in the two oldest yet known crocodiles *Beledon* and *Stagonolepis* of the Triassic epoch. To compensate for the firm attachment of the *os quadratum* to the skull, the symphisis of the mandibles of the lower jaws is united by a fibrous ligament, and the bases of the upper jaws are concaved and move on a convexed ridge surface of the lower jaws. This enables them to move backwards or forwards, and helps mastication, which would not be possible were the lower jaws firmly united at the symphisis.

The dentition of Sphenodon is very curious. When young it has four incisor teeth in each jaw, which co-ossify in old age, and then form only two in each jaw, which are wedge-shaped, hence the name of the genus. There are two rows of teeth in the upper jaws, close together, forming a groove for the reception of lower ones, and they are anchylosed to maxillary and palatine bones, and have a sharp cutting edge. Sphenodon has biconcave vertebræ like fishes, uncinate processes attached to the ribs as in

birds, a rounded clavicle and a T shaped interclavicle like *Ornithorhynchus* and *Ichthyosaurus.* The sternum and abdominal ribs are more developed than in any other reptile. All the earlier lizards at present known had biconcaved vertebral centra, while all but a few of the existing species have the centra hollow in front and convex behind.

The nearest allies of Sphenodon are *Hyperodapedon* and *Rhynchosaurus.* These fossil forms are found in the Triassic formation, and differ from all other lizards recent and fossil, in the massive beak-like structure of the jaws, with maxillary and palatal teeth running in a groove for the reception of the lower jaws. The abdominal ribs are greatly developed. The vertebral system of the lizards has undergone a change corresponding to that which has occurred in that of the crocodiles. Lacertilia existed in the Palæozoic epoch, differing less from Sphenodon than they did from *Hyperodapedon* and *Rhynchosaurus.* A new fossil lizard allied to Sphenodon has been discovered in the Permian beds near Dresden. It has been described by Dr. Herman Credner of Leipsic, under the name of *Kaladiosaurus priscus,* or "the ancient stilt walker," so named from the length and slimness of the limb bones, which are proportionately longer and more slender than those of the Palæo-hatterian group, to which some authorities consider Sphenodon belongs.

In dissecting a specimen of Sphenodon one finds on removing the skin from the top of the skull a small hole called the parietal foramen. Mr. W. B. Spencer recently discovered this to contain a rounded substance which upon careful examination proved to be an eye, with retina, pigment, lens, and a nerve enveloped in connective tissue passing from the foramen to the interbrain, and he found a continuous nervous connection between this single eye and the pineal gland. This nerve has apparently disappeared in the majority of other reptiles and amphibia. It is, however, also present in the Iguana, the common Chameleon, and *Lacerta ocellata.* In the cerebral hemisphere of the human brain there is a similar globular body about the size of a pea. Till within the last few years no idea could be formed as to its nature, but it is now considered to be an organ of sight, and the last trace of the single cerebral eye formerly characterising our remote one-eyed ancestors. There are certain marine animals ranging from the Arctic to the tropical seas called Ascidians or sea squirts, because when left dry on the rocks they eject water if touched. One species, *Phallusia,* resembles a leather bottle with two necks; water is constantly passing in at one orifice and out at the other. Beneath the outer covering there is a soft animal with a large perforated gill-sac, and below the gill-sac lies a spindle-shaped heart, a simple tube exhibiting a remarkable peculiarity. It contracts in alternate directions, pulsating first from back to front, resting

about half-a-minute ; it then beats in the opposite direction, thus constantly changing arteries to veins, and its veins to arteries. Small oval bodies can be seen in the body cavity ; these are the eggs. The young *Phallusia*, when it has reached its full development within the egg, moves vigorously, causing the egg covering to burst. The little animal as it emerges from the egg has a notochord, above which lies a rudimentary medullary tube, and it then assumes quite a different form from that of its parents. It has the same general characters as the young frog when in the tadpole stage. There is a slight difference in the shape of the mouth and position of the organs of vision,—the young Ascidian having but one eye, while the tadpole frog possesses two eyes, and, as Professor Ray Lankester has clearly shown, it had in common that which all other vertebrates had at one time of their lives, including man, a notochord, a throat perforated with gill-slits, a spinal cord, and a cerebral eye imbedded in its brain.

In the spring of 1888 many of these animals were to be seen firmly fixed upon oyster shells, stones, and the walls of Tank No. 26 in the Brighton Aquarium. I drew the attention of my fellow-student, Mr. J. E. Haselwood, M.R.M.S., to them, and, with the consent of the Aquarium Directors, Mr. Wells, the Superintendent, carefully removed some by sinking a jar to the bottom of the tank and then placing some oyster shells therein, without disturbing in the least the Ascidians attached to the shell. They were placed in a glass jar and regularly supplied with fresh sea-water, but after a few days they shrivelled up and died, much to our disappointment.

Mr. Haselwood afterwards mounted some of the eggs, and they formed very interesting microscopic objects. We subsequently visited the Royal College of Surgeons together, and, through the courtesy of Professor C. Stewart, were shown beautiful specimens of tadpole Ascidians in alcohol.

At that early stage the young Ascidian swims about in the sea by means of its vertebrate tadpole-like tail, but this youthful condition is soon at an end. Then it sinks to the bottom of the sea, attaches itself by its head to stones, corals, shells, &c., and becomes permanently fixed. The tale atrophies, together with the notochord, and the body soon takes the shape of a leather bottle with two necks.

We have, therefore, evidence that these lowly degenerate vertebrates were probably at a very remote period of the earth's history the ancestors of all the great group of vertebrates, including man, and that one eye alone was the only organ of vision. The two eyes were afterwards developed. In the third non-functional parietal eye of the living New Zealand lizard, Sphenodon, we have doubtless a survival of the single cerebral eye of the retrograded Ascidians, which form one of the most instructive

illustrations of the origin of species by degeneration. For it is well to bear in mind the words of Herbert Spencer, "Evolution does not imply as commonly conceived an intrinsic tendency in everything to become something higher."

I am indebted for information to the publications of the following authorities: Dr. A. Günther, F.R.S., Professor Ray Lankester, F.R.S., Professor Huxley, F.R.S., Professor Rupert Jones, F.R.S., and Professor Ernst Haeckel. I wish to express my obligations to Mr. B. Lomax, F.L.S., for the beautiful and accurate enlargement (after Haeckel) of the anatomy of an Ascidian, which will be placed in the Museum, as it is almost impossible to obtain or exhibit specimens of such a perishable nature, and excellent diagrammatic representations of them are most useful for the instruction of students.

WEDNESDAY, MAY 7TH, 1889.

DR. NEWSHOLME

(MEDICAL OFFICER OF HEALTH FOR BRIGHTON),

ON

SOME PROBLEMS OF POPULATION.

The laws regulating the number of the human species formed a most complex and perplexing subject. In a general study, it would be well to consider :—(1) The past progress of the English population ; (2) Urbanization and its sanitary and social effects ; (3) The effect of improved sanitary condition on the population problem ; and (4) The limits to the increase of the population.

There was no census before 1801, but in the 14th century the population of England and Wales was estimated at two and a half millions ; and at the same number in the 16th century. In 1700 it had risen to 5,475,000, and in 1801 to 8,892,536 ; thence rapidly increasing to 25,974,489 in 1881. If, instead of accepting actual enumerations, one took the increase as determined by the excess of births over deaths, the effect of migration would be eliminated ; and that this natural increase varied greatly in different countries was shown by the fact that, taking the excess of births over deaths, England and Wales would double itself in

54·5 years, Scotland in 54·8, Ireland in 178, Norway in 50·2, Austria in 80, the German Empire in 54·8, Prussia in 47·5, Italy in 93, and France in 534 years. It was worthy of note that, although France and Ireland stand lowest on the list, Canadian French and American Irish are very prolific.

The distribution of power in Europe was effected by the varying growths of populations. Figures were given showing that, comparing 1815 with 1880, Russia has very slightly increased its proportion of the total European population; Germany and England have very greatly increased their proportion; while Austro-Hungary and still more France have greatly declined in the comparative scale.

Urbanization formed an important feature of recent years. In 1861, the urban population of England and Wales formed 62·3 per cent. of the whole, in 1881 it had risen to 66·6 per cent. Much of this increase was due to immigration from rural districts; in Brighton the whole of its increase in excess of that for the whole country was due to immigration. The alleged depopulation of rural districts had been exaggerated; they had remained nearly stationary. Owing to the fact that urban populations were replenished largely by young persons at an age of low mortality, their age-distribution was favourable to a low rate of mortality. Dr. Richardson some years ago stated to the Corporation of Brighton that the presence in Brighton of old and worn-out lives must add about 1 per 1,000 to its annual death-rate. But on examination Dr. Newsholme found that the death-rate of last year should have been 15·57 instead of 15·04 per 1,000, had the population of Brighton been composed like that of the country as a whole. In other large towns the correction required was much greater than this. In spite of their favourable age-constitution, urban populalations have a higher mortality than rural. This was owing to density of population, the accumulation of refuse in neighbourhood of houses, and other causes. As indicating the greater attention to sanitation in towns, it was satisfactory that while the urban death rate in 1861-70 was 20·5 per cent. higher than the rural, in 1888 it was only 9·2 per cent. higher. Dr. Farr had laid down the law that the mortality of a town held a definite proportion to its density. By examples, however, it was shown that this supposed law was controverted by present experience; and there was absolutely no reason, with increased attention to the laws of health, why our towns should not approach and perhaps attain as high a standard of health as did the healthiest rural districts.

The remarkable decline in the English death-rate since the enforcement of the Public Health Act was then shown in detail. This decline meant, for instance, that in the year 1888 there were 130,000 fewer deaths than would have occurred had things gone on as in the previous decennium. This decline might be

regarded by ardent Malthusians as a doubtful good; but there was every reason to think that the same causes which led to a lowered mortality had produced an improved standard of health among survivors. There had also been a lowering of the birth-rate, so that the population had not been growing at a greater rate during the past ten years than before the saving of lives occurred. Evidently the limits of subsistence had not been reached, or we might expect to see all classes gradually converging from other employments towards agriculture; whereas in most countries the exactly opposite phenomenon was occurring. The same fact was shown by the diminished pauperism in this country, the number having fallen from 45·7 paupers per 1,000 of population in 1857 to 24·2 per 1,000 in 1889. The increased consumption of luxuries showed the same thing. While over one million pounds of tea, coffee, and cocoa were consumed in this country in 1856, over 245 million pounds were consumed in 1888. The average workman was now getting from 50 to 100 per cent. more wages for 20 per cent. less work than 40 or 50 years ago. It was true that between 1820 and 1880 over eight million persons had emigrated. But war, pestilence, and famine were not the only means of limiting population. The standard of comfort in all classes was being steadily raised, and would be raised still more as education became more general. This higher standard of comfort would lead to the postponement of marriage until the standard could be realised. It was evident that emigration and colonisation must eventually cease. In about a century the population of the United States had increased from three millions to about 65 or 70 millions. If the same rate of increase continued for another century, the density of population in the States would be 500 persons per square mile as compared with 492 persons per square mile at present in England and Wales. In that ultimate issue how could the growth of population be restrained? In this country the birth-rate was at present governed by the number of marriages and the ages at marriage of women. The illegitimate birth-rate had declined, in spite of the lowering of the marriage rate which had occurred. If one-fourth of the women who now marry were to remain celibate, and if those who do marry were to marry five years later than at present, the birth-rate would just balance the present death-rate. Such abstinence from marriage was not desirable, but among the working classes it was desirable that the average age of marriage should be increased, and there were educational influences at work which would probably lead to this. In a historical review of the subject, it was evident that depopulation of some countries occurred as well as over population of others. It might be that laws of population existed, of which little was as yet known. Undoubtedly the progress of population *can* be stayed should it

ever become necessary. It *should* be stayed in individual cases by continence when the means of subsistence for a family are lacking. But while there are vast tracts of Australasia and Canada still comparatively unoccupied, while Africa furnishes a vast field for enterprise, this country should take her pre-eminent share in colonising and Christianising the world. And in the end it might reasonably be hoped that there would be no necessity to resort to what was euphemistically designated Neo-Malthusianism.

WEDNESDAY, JUNE 11TH.

MR. E. A. PANKHURST

ON

THUNDERBOLTS—TRUE AND FALSE.

Mr. Pankhurst first described the appearance of a thunderbolt. To the ordinary dweller on the chalk or in its neighbourhood, a thunderbolt, he said, is a nodular, smooth, heavy brown mass, that on being broken open exhibits a brassy metallic lustre, and a radiating structure. Those who have to do with our Museum know how often these are offered, sometimes at a high price, as a valuable addition to our collection of rare and curious objects. These, however, are not "bolts" in any sense of the word and are entirely innocent of "thunder." They are compounds of sulphur and iron, have been formed quietly in the depths of the chalk, and have generally generally been washed out of the cliffs by the action of the sea, which has subsequently rolled and smoothed them. The things which Jupiter Tonans or Thor might have hurled on the earth are very different both in structure and composition.

Notwithstanding many accounts of the fall of stones which history records, the scientific men of the last century for a long time refused to believe that any bodies came to us from extra-terrestrial space. On an undoubtedly genuine meteorite being shown to Lavosier, he affirmed that it was one of our old friends of the chalk which had been struck by lightning. Others said they were formed in the clouds or hurled from some volcano, near or distant. In 1803, however, there was

an extraordinary fall at L'Aigle in France. The accounts of it were greeted with ridicule, but the French Government appointed a Commission to inquire into the circumstances, and the celebrated Biot reported that about 2,000 stones had undoubtedly fallen from the sky. Soon afterwards it was shown that these stones possessed characters and included substances which had never been observed in the rocks of the earth. It was Chladni, however, who just a hundred years ago, in Germany, first asserted the extra-terrestrial origin of these bodies, rescued them from indifference and neglect, and insisted on the enormous importance of their study.

We have all of us (proceeded Mr. Pankhurst) seen what are termed "shooting stars." These are small bodies, which, entering our atmosphere with a velocity of 20 or 30 miles a second, are burned up by the heat engendered by their very friction against the gaseous particles or atoms of the air. It is calculated that at least 20 millions of these bodies enter our atmosphere every 24 hours; and on some days of the year a vastly greater number. It may have been the good fortune of some of us to see the landscape suddenly lit up by an intense brilliancy, and, on directing our eyes to the sky, to observe an apparently large body moving swifting through the heavens, burning with a beautiful red or green light, and leaving behind it a long luminous trail. This we call a meteor. It is but a larger shooting star, and it is in such as these that our interest centres this evening. Sometimes they reach the earth only partly consumed. These are the true thunderbolts of the gods. It is these which have been in all ages an object of fear or worship to multitudes of men. Sometimes, as in Rome, they have been the centre and focus of the religion of a nation. They are objects of devotion now to semi-barbarous races, who know not what it is they ignorantly worship, and in more enlightened nations to enthusiastic collectors who gloat in secret over their accumulated treasures.

The greatest devotee of a meteorite, ignorant or scientific, would scarcely choose, however, to be in the immediate neighbourhood when one of a large size arrived on the earth. Their advent is generally accompanied with a roar of thunderous detonations like the discharge of a park of artillery. "The firmest houses," says an eye witness of a fall, "were shaken to their foundations, and thousands of sleepers aroused in an instant. People awake at the time were startled to see the night suddenly lighted into day, and again relapse into darkness." More than once they have been seen to be red hot when they touched the earth. So different is their velocity on different occasions, that while sometimes they bury themselves several feet in the gound, at others, stones a pound or two in weight have bounded from ice four inches thick without breaking it. The detonations are

caused by the breaking-up of the stone into fragments, sometimes into one or two thousand pieces, at others into two or three only.

Meteorites may be roughly divided into three classes :—I., those wholly metallic (Siderites) ; II., those composed of stone and metal in about equal proportions (Siderolites) ; III., those in which stony matter largely preponderates (Aerolites). Mr. Pankhurst pointed to a model of a typical specimen of the first class seen to fall in Arabia in 1865. Ninety-two per cent. of it was pure iron, the remainder nickel. No other metals but these two are found in the metallic state in meteorites. Common as iron is, it is one of the rarest things on earth in its pure state. It is not the least remarkable of the many remarkable things connected with these bodies that the purest iron men have hitherto obtained has come from the sky. These alloys of nickel and iron often show a beautiful crystallization. About 20 years ago a notable discovery was made in Greenland. In a vast outpouring of basalt huge masses of an alloy of iron and nickel were discovered. It is analogous in composition to that of some meteorites, and among other substances was accompanied by graphite and olivine.

The second class (Siderolites) is represented by specimens of the stones which fell at Estherville in Iowa in May, 1879. The largest mass weighs 437 lbs. and is now in the British Museum ; one of the smallest, in Mr. Pankhurst's own possession, only 15 grains. Nearly 1,000 lbs. weight of matter came to the earth at this fall. Of the third class (Aerolites) there is a characteristic specimen from the Brighton Museum collection, which fell at Pultusk in Poland in 1868. Some two thousand are said to have fallen ; great numbers, however, being very small. By the side of the Pultusk stone is a section of a very similar one which fell at Mocs in Transylvania in 1882. It is a typical specimen of an Aerolite. The grey rocky matter is mainly silica, magnesia, and iron, and, curiously enough, it is analogous in composition to those lavas which are regarded as having been erupted from the deepest portions of the earth's crust. Scrutiny through a microscope throws some light on the strange secrets of its genesis. It is largely built up of small spherical granules (chondoi) which seem to have condensed in molten drops from some fiery cloud. Mineralogically, the rocky portion of meteorites mainly consists of bronzite, enstatite, and olivine. In some stones a species of felspar is found ; sulphur also, though generally in combination with metals, and in some very extraordinary stones carbon is met with. The elements which principally enter into their composition are iron, nickel, oxygen, magnesium, aluminium, carbon, sulphur, chromium, and phosphorus. No new element has been found, but several compounds peculiar to the laboratory of space.

Alluding to the presence of diamonds in meteorites, Mr. Pankhurst said he had mentioned carbon as one of the constituents of these sky-stones. The commonest substance on the crust of the earth, carbon, is one of the rarest in its crystalline form, namely, as the diamond. The scientific world was somewhat startled a few years ago by the announcement that diamonds had been found in meteorites. The carbon in this case in not transparent, but black, opaque, and exceedingly hard. Within the last two or three years, some extraordinary stones have fallen which have yielded this crystallised carbon. The rock with which it has been associated is that silicate of magnesia and iron to which I have before alluded. One common form of it is Olivine. And hereby hangs a tale and a very extraordinary one. Here, he said, pointing to a specimen on the table, is a diamond, in its rocky matrix from South Africa. The diamond-bearing rocks of that part of the world are all of this character. It is an old lava probably erupted from great depths. In the course of ages it has been much altered by the infiltration of water, &c. ; but here and there particles are found of the original rock, and this is strictly analogous in composition to that silicate of magnesia and iron which is the faithful companion of all meteorites, and which forms so large a constituent of the rocky matter in which the last sky-diamonds have been found. Yet another fact not less extraordinary. A diamond is nearly related to petroleum. A diamond is pure carbon. Petroleum is carbon plus hydrogen. The origin of such large quantities of this substance in the lower strata of the earth's crust has long been one of the great unsolved problems of geology. Now, strange to say, there are meteorites from which a hydro-carbon allied to petroleum has been extracted. Some five or six meteorites are known which are more or less bituminous.

Whatever origin we may ascribe to meteorites, there is little doubt but that they represent to us the constitution of the earth in the earlier ages of its existence. They are representatives of a time when its carbon, hydrogen, sulphur, iron, &c., formed combinations or assumed shapes not possible under later conditions. What, then, is the origin of those singular visitors to our globe? Have they been ejected from the volcanoes of the earth in the earlier epochs of its history, circulating for ages round the sun until the attraction of the parent has brought them back again to it? There is much to be said both for and against such a theory. The density of the earth as a whole is greater than that of the rocks on its surface. The interior is, therefore, possibly to some extent metallic. The earth is also a great magnet. If iron predominates in the earth's interior, as in meteorites, a remarkable phenomena would be explained. Are they, again, the shattered fragments of a planet that has fulfilled its destiny, the dust and ashes of a vanished world? This is an idea that has found favour

with many. Have they been ejected from the sun itself? If so they would probably have fallen back again to it surface. Are they, again, connected with comets?

There is one notable circumstance in the history of astronomy that cannot, in connection with the subject, be overlooked. In 1856 a comet (Biela's) that had in preceding revolutions round the sun undergone strange mutations, was anxiously looked for by astronomers. It never appeared at its appointed place, but the gazers who were searching for a glimpse of it were greeted with the radiant lines and points of thousands of shooting stars. The comet has never re-appeared, but the orbit of that swarm of meteoric bodies is identical with the path of Biela's comet. The examination of the microscopic structure of these stony bodies, as I have already remarked, points to their condensation from a fiery vapour. In the coldness of space is the heated gaseous substance of a comet condensed into these nodules? Are comets themselves but shreds of that nebulous matter which astronomers perceive in the depths of space and out of which systems perchance are formed? Was not the earth itself once but a huge meteor, pursuing its path round the sun ere yet that fragment was sundered from it which we now call the moon? Men sometimes speculate as to the nature of other worlds than this. Are not these the only embodied revelations we get of the unknown universe beyond us? I hold in my hand one of the smallest of these voyagers through the depths of space that has found its way to our globe. "Nature," says a recent writer, "knows nothing of great or small. These are but relative terms. When I hold one of these tiny meteorites between my fingers I grasp, in fact, a planet."

Brighton and Sussex Natural History and Philosophical Society.

TREASURER'S ACCOUNT FOR THE YEAR ENDING 11TH JUNE, 1890.

Dr.

	£	s.	d.
To Balance in the hands of Treasurer, June, 1889	148	10	6
" Annual Subscriptions and Arrears to 1st October, 1889	14	10	0
" Annual Subscriptions to 1st October, 1890 ...	18	10	6
" Entrance Fees	4	0	0
	£185	11	0

Cr.

	£	s.	d.
By Books and Periodicals	6	15	10
" Bookbinding	2	8	3
" Printing Annual Report and Abstract of Proceedings	14	0	0
" Printing and Stationery	6	15	0
" Postage, &c.	8	15	8
" Subscriptions to Societies	3	14	10
" Assistant Secretary's Salary	2	2	0
" Gratuities to Assistants at Museum	2	10	0
" Expense of Annual Excursion	3	6	0
" Hire of Room and other incidental expenses of Meetings	1	1	6
" Cost of Tea and Coffee at Meetings	1	3	7
" Fire Insurance	0	12	0
" Balance in hands of Treasurer, 11th June, 1890	132	6	4
	£185	11	0

Balance in hands of Treasurer, 11th June, 1890 £132 6 4

Dr.

To Amount in hands of the previous Collector, shown in last Account £16 5 6

Cr.

By amount written off by instructions of Council 16 5 6

Examined with Books and Vouchers,

F. G. CLARK,
J. E. HASELWOOD, } *Honorary Auditors.*

ANNUAL GENERAL MEETING,

HELD

JUNE 11, 1890.

MR. GEORGE DE PARIS (President) IN THE CHAIR.

REPORT OF THE COUNCIL

FOR THE YEAR 1889-1890.

Your Council has to report that the usual number of meetings of the Society has been held during the past year, all but two in the room in which we are now assembled. The first of these was in the King's Apartments, Royal Pavilion, and the second was at the Hove Town Hall. Your Council has conveyed to Mr. J. W. Howlett (Chief Commissioner of Hove) its cordial thanks for his kindness in placing a room at the disposal of the Society on that occasion and for his hospitality in entertaining the Members. The thanks of the Society are also due and are heartily given to Mr. H. V. Shaw for the invitation so generously given to our Members for a Garden Party at Keymer on the 21st June last, and which was accepted by a considerable number.

The Annual Excursion, which took place on Tuesday, the 2nd of July, to Goodwood, visiting Halnaker House and Boxgrove Priory *en route* was also a great success. It may be noted that ladies for the first time took part in the Annual Excursion on this occasion. On December 12th last about 35 Members of the Society dined together at Booth's Restaurant in East Street, Mr. G. De Paris presiding. The Mayor of Brighton (Mr. Ald. Manwaring), Mr. J. W. Howlett (Chief Commissioner of Hove), and the Rev. Prebendary Hannah were among the guests on that occasion.

Your Council has to deplore the loss by death of two of the Vice-Presidents of the Society, who were amongst its oldest members, viz., Mr. T. R. Simonds and Mr. J. P. M. Smith. It also has to state with regret that the Society has lost by death and resignation 27 Members since the last Annual Meeting. Fourteen Ordinary Members and three Honorary ones have, however, been elected.

For special reasons the day of meeting of the Society was altered at the beginning of this year from the second Wednesday in the month to the first, but, as the reasons for which such alteration took place no longer exist, your Council proposes that, in future, the Ordinary Meetings take place as before, on the second Wednesday in the month.

The papers read before the Society have been as follows :—

Oct. 9th, 1889	Inaugural Address by the President (Mr. George De Paris). Subject: "The Relation of Art to Science."
Nov. 13th, "	Remarks on the Laws of Nature—Mr. W. E. C. Nourse.
Dec. 4th, "	"Instinct"—Mr. J. E. Haselwood.
Jan. 8th, 1890.	Evening for Specimens. Mr. E. C. Crane, F.G.S., read a short paper on "The Crocodiles in our Museum."
Feb. 5th, "	"The Evolution of Music": Mr. H. Davey, Jr. Meeting held in King's Apartments, Royal Pavilion.
Mar. 5th, "	"The Optics of the Eye": Mr. W. H. Rean, M.R.C.S.
April 2nd, "	"Sphenodon and its affinities": Mr. E. C. Crane, F.G.S.
May 7th, "	"Some Problems of Population": Dr. Newsholme (Medical Officer of Health for Brighton).
June 11th, "	Annual General Meeting. At the Ordinary Meeting following, Mr. Edwd. Alloway Pankhurst read a paper on "Thunderbolts: True and False."

The thanks of the Society are due and are hereby given to those Gentlemen who have read Papers before the Society.

The Field Excursions have been as follows :—

1889.	June 15th.	Balcombe.
"	June 21st.	Garden Party, Fir Croft, Keymer. Mr. H. V. Shaw's.
"	July 13th.	Dyke—walk to Hassocks.
"	Aug. 10th.	Crowborough—walk to Rotherfield.
"	Sept. 14th.	Haywards' Heath—walk to Lindfield.
"	Oct. 12th.	Dyke—walk to Bramber.
	Annual Excursion, Tuesday, July 2nd—Chichester and Goodwood. Visited Halnaker House and Boxgrove Priory *en route*.	
1890.	April 12th.	Falmer—walk to Lewes.
"	May 10th.	Polegate—walk to Willingdon.
"	June 7th.	Glynde—walk to West Firle.

LIBRARIAN'S REPORT.

There has been but very little change in the Library during the past year.

The Members still continue to use the books; but yet there is room for improvement, and it would give great satisfaction to your Council to see the Members availing themselves more largely of the valuable Library belonging to the Society.

There have been eighty books lent to the Members during the year, and the Library is largely used for reference purposes by the general public.

The following serials are taken in and may be obtained for persual on application :—

> British Mosses, Annals of Botany, The Entomologist, Entomologists' Monthly Magazine, Geological Magazine, Geologist Association, Journal of Geological Society, Grevillea, Nature, Palæontographical Society's publications, Queket Microscopical Club, Ray Society's publications, Royal Microscopical Society, Science Gossip, Zoologist, The Selborne Magazine for Lovers and Students of Living Nature.

During the past year there have been presented to the Society the following books, and the best thanks of the Society are due to those ladies and gentlemen who have so kindly forwarded books to the Society :—

> Cardiff Naturalist Society, Transactions, Report. Proceedings and Transactions of the Natural History Society of Glasgow. Proceedings and Transactions of the Croydon Microscopical and Natural History Club, one volume. Proceedings of the Geologists' Association and Quarterly Journal Geological Society, from Henry Willett, Esq., Arnold House, Brighton; a Chapter in the History of Meteorites, and Phillips' Manual of Geology, from Mrs. Henry Woollams.

Signed, D. E. CAUSH,

Hon. Librarian.

[*For* TREASURER'S REPORT, *see page 42.*]

After the Reports had been read it was moved by Mr. H. Davey, seconded by Mr. E. F. Salmon, and resolved—

> "That the Reports now brought in be received, adopted, entered on the minutes, and printed for circulation as usual."

It was moved by Mr. E. J. Petitfourt, seconded by Mr. Thomas, and resolved—

> "That the Treasurer's account be submitted to the Auditors examined by the Council, and printed with the report."

It was moved by Mr. Wells, seconded by Dr. Harrison, and resolved—

> "That the following gentlemen be Officers of the Society for the ensuing year :—*President:* Mr. G. De Paris ; *Ordinary Members of Council:* Surgeon-General J. J. Clarke, M.D., Mr. W. H. Rean, M.R.C.S., Mr. H. Langton, M.R.C.S., Mr. J Walter, Dr. A. Newsholme, M.R.C.S., and Mr. E. J. Petitfourt, B.A. ; *Honorary Treasurer:* Dr. McKellar, Woodleigh, Preston ; *Honorary Librarian:* Mr. D. E. Caush ; *Honorary Curator:* Mr. Benjamin Lomax, F.L.S. ; *Honorary Secretaries:* Mr. Edward Alloway Pankhurst, 12, Clifton Road, and Mr. Jno. Colbatch Clark, 64, Middle Street."

Dr. W. Harrison moved, Mr. Marshall Leigh seconded, and it was resolved—

> "That the sincere thanks of the Society be given to the Vice Presidents, Council, Hon. Librarian, Hon. Curator, and Hon. Secretaries for their services during the past year."

Mr. H. Davey moved, Mr. Wells seconded, and it was resolved—

> "That the best thanks of the Society be given to Mr. George De Paris, for his attention to the interests of the Society, as its President, during the past year."

Mr. E. J. Petitfourt proposed, Mr. C. F. Dennet, seconded, and it was resolved—

> "That the special thanks of the Society be given to Mr. Thomas Glaisyer, for his long and valuable services as Treasurer during the past 16 years."

The meeting was then resolved into an Ordinary Meeting.

SOCIETIES ASSOCIATED,

WITH WHICH THE SOCIETY EXCHANGES PUBLICATIONS,

And whose Presidents and Secretaries are *ex-officio* Members of the Society :—

Barrow Naturalists' Field Club.
Belfast Naturalists' Field Club.
Belfast Natural History and Philosophical Society.
Boston Society of Natural Science (Mass., U.S.A.)
Cardiff Naturalists' Society.
Chester Society of Natural Science.
Chichester and West Sussex Natural History Society.
Croydon Microscopical Society.
Department of the Interior, Washington, U.S.A.
Eastbourne Natural History Society.
Edinburgh Geological Society.
Epping Forest and County of Essex Naturalist Field Club.
Folkestone Natural History Society.
Geologists' Association.
Glasgow Natural History Society.
Glasgow Society of Field Naturalists.
Huddersfield Naturalist Society.
Leeds Naturalist Club.
Lewes and East Sussex Natural History Society.
Maidstone and Mid-Kent Natural History Society.
North Staffordshire Naturalists' Field Club.
Peabody Academy of Science, Salem, Mass., U.S.A.
Quekett Microscopical Club.
Royal Microscopical Society.
Royal Society.
Smithsonian Institute, Washington, U.S.A.
South London Microscopical and Natural History Club.
Société Belge de Microscopie, Bruxelles.
Tunbridge Wells Natural History and Antiquarian Society.
Watford Natural History Society.
Yorkshire Philosophical Society.

LIST OF MEMBERS

OF THE

Brighton and Sussex Natural History and Philosophical Society,

JUNE, 1890.

N.B.—Members are Particularly requested to notify any change of address at once to Mr J. C. Clark, 64, Middle Street, Brighton.

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HEBB, MISS, Annesley Hall, Dyke Road.
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J. G. BISHOP, Printer, "Herald" Office, Brighton.

With the Author's Compliments.

THE

ANTIQUITY OF MAN

A PAPER READ BEFORE THE

Brighton and Sussex Natural History and Philosophical Society, Xref

IN THE KING'S APARTMENTS, ROYAL PAVILION, ON WEDNESDAY EVENING, NOVEMBER 15TH, 1890.

BY

SAMUEL LAING. K

Brighton:
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THE ANTIQUITY OF MAN.

The antiquity of man is a subject of such surpassing interest that I have selected it in response to a request to write a paper for the meeting of this Society. My chief difficulty is that the subject is so extensive that it would require a volume, rather than a short paper, to discuss it fully. I will endeavour, however, to confine myself to a few salient points, and to the light thrown on the question by the latest discoveries, and trust to your indulgence if many important matters seem to be omitted, or mentioned too briefly.

The Historic Period.

I must begin by saying a few words as to the historical period, for here also recent discoveries have thrown a light on ancient records, which have revolutionized previous conceptions almost as completely as those of geology and palæontology have done those of the periods which precede history. The historical period is also of primary importance, because it affords the first measuring rod, or standard of dates, from which we can rise to the far more distant dates of geological periods. As in space we rise from standards verifiable by a strict measurement, such as the metre, the mile, and the arc of the meridian, to inferences derived from them by reason such as the dimensions of the earth, the distances of the sun, moon, and planets, and finally those of the nearer fixed stars; so in time, history affords the standard in years, from which we have to work back in trying to assign an approximate date for prehistoric, neolithic, palæolithic, and possibly pre-glacial or tertiary traces of human existence. By neolithic and palæolithic we must understand that these denote the classification of ancient remains of the stone age, from the earliest rude implements of chipped flints found in the oldest deposits, down to those of polished stone which are found in more recent deposits which immediately precede the historic period. Now, as I have said, ancient history has been revolutionized in recent times by two great discoveries. One

that of reading the hieroglyphic inscriptions on old Egyptian monuments, tombs, and manuscripts; the other that of reading the cuneiform inscriptions on brick tablets, which carry us back to the earliest days of Chaldean civilization. We are thus able to test the historical dates of these ancient empires by contemporary monuments compared with one another, and with the fragments of annals which have come down to us from historians of undoubted date and authority, like Manetho and Berosus. It would take far too much time to explain this in detail, and it is a case where all who are not themselves experts must rely on the latest conclusions of the men of highest authority who have devoted their lives to those studies. In the case of Egypt, Mariette, who has done more than any man to discover monuments of the older dynasties, after a careful comparison of all the records with the lists of Manetho, arrives at 5,004 B.C. as the date of Menes, the first historical king of the united provinces of Upper and Lower Egypt; and there is a general consensus of opinion among all modern Egyptologists, that this date must lie between the limits of 4,500 and 5,500 B.C. In the case of Chaldea there is equally a consensus of the best and latest authorities, that the date of 3,800 B.C., fixed by the tablets for the reign of Sargon the First of Accade, must be accepted as historical, and that a long preceding period must be allowed for the Accadian civilization, which preceded the growth of a Semitic population and influences which led to the establishment of a Semitic dynasty under Sargon.

The Ages of Myth and Legend.

In each case, therefore, we arrive at the same conclusion, that a period of about 7,000 years from the present time must be assigned for the commencement of authentic history, beyond which we pass into a pre-historic period prior to written records, when everything fades rapidly away into myth and legend. In each case also we arrive at the same result, that at this dawn of authentic history Egypt and Chaldea are already far removed from the primitive conditions of the neolithic period, and are already populous and civilized communities, with old and famous cities and temples, far advanced in mechanical science and in the fine and industrial arts, with no mean knowledge of astronomy, and with highly metaphysical systems of philosophies and religions strangely intermixed with old superstitions and popular practices of magic, fetishism and animal worship.

The Neolithic Period.

How long this may have taken prior to the commencement of written history is a matter of conjecture. We have no data to go upon as to the number of years which it may have taken to develop such an advanced civilization, without contact with

superior races by conquest or commerce, by the evolution of native populations from the rude conditions of the neolithic period. Nor does this neolithic period afford us much assistance. It is of extreme interest as showing the progress of civilization in prehistoric times among the early races of Europe, and enabling us to trace the origin of many of its existing populations. But for chronological purposes we are met by the difficulty that the historical records of Egypt and Chaldea go back so far that we can find no assurance that even the earlier of the Swiss Lake dwellings, may not have been contemporary with, or subsequent to, the great dynasties of Memphis and of Babylon. In those countries whose history goes so far back, the neolithic period is buried under the ruins of civilization, and the accumulations of alluvial deposits, and the traces which connect the dyke of Menes and the Pyramids with the preceding stone age, are few and far between. All we know for certain in Egypt is that borings in the Nile Valley have brought up fragments of pottery, apparently of neolithic age, from depths which are conjectured to show an accumulation of Nile deposits at the existing rate for about 18,000 years back, that neolithic flint implements have been found at various points near Cairo and Thebes, and that celts and scrapers of the usual palæolithic type have been found in gravels of undoubted quaternary antiquity in ravines near Thebes. In Chaldea the connections of the ancient civilization with a stone age is even slighter, and reduces itself to the fact that palæolithic implements have been found near Bagdad in old gravels of the Euphrates and Tigris. When we wish, therefore, to retrace the stream of human origin beyond the period of perhaps 10,000 years, which is the shortest time we can allow for the growth of such a civilization as we find actually existing 7,000 years ago, we have to fall back exclusively on considerations drawn from the exact sciences, such as geology, astronomy, anthropology, and palæontology. The key of the problem is in the glacial period.

The Glacial Period.

It is clearly established that the recent period during which the conditions of climate, physical geography, fauna and flora, have been substantially the same as at present, was preceded by a long glacial period, during portions of which a great part of Europe and America were buried under ice-caps and glaciers. It is clear also that this glacial period did not consist of one appearance and disappearance of intense cold, in comparatively recent times, but that it came on towards the end of the pliocene age; rose rapidly to a maximum of intensity when an ice-cap from Scandinavia filled the Northern Seas, overflowed mountain chains, and carried its boulders as far south as the Thames Valley and central Germany; while gigantic glaciers from the Alps and other chains of lofty mountains buried Switzerland, choked up the

valleys, and abutted against the Jura at a height of 3,000 feet. This was followed by a long inter-glacial period, with several minor oscillations, during which the climate was not very different from that of the present day, and which lasted long enough to enable a temperate vegetation to overspread large districts which has been covered by glaciers and frozen snow, and to bring the hyena, hippopotamus, and other forms of an African fauna as far north as Yorkshire. Again a second glacial period set in, which, although not so intense as the first, was sufficient to convert the plains of Southern France and Germany into tundras like those of Lapland, over which herds of reindeer roamed, feeding on arctic willows and lichens.

A Great Geological Phenomenon.

Nor are these phenomena confined to Europe. On the contrary, we find the same sequence of an intense glaciation, an inter-glacial period, and a second glaciation, less intense than the first but still severe, followed by the recent or post-glacial period, repeated on a still larger scale in North America; while the traces of enormous glaciers in the Caucasus, Himalayas, Andes, and South Africa, show that the glacial period was a great geological phenomenon, not confined to one portion of the earth's surface or to one hemisphere.

The Oldest Types.

Now the evidence is conclusive for the existence of man throughout the whole of this glacial period. It is very strong, as we shall see presently, for his existence in pre-glacial and even in tertiary times. But it admits of no doubt that he formed a characteristic feature of the quaternary fauna comprising the cave bear, the mammoth, the woolly rhinoceros, and other extinct animals, which came in at the close of the pliocene period. Innumerable palæolithic implements, and numerous skulls and bones have been found in conjunction with this fauna, not only in the high level gravels of existing rivers when they began to excavate their present valleys, but in the gravels and silt of pre-glacial rivers and in caves securely sealed under successive sheets of stalagmite, when the drainage and physical geography of the districts were altogether different. And it is to be specially noted that these palæolithic remains of the oldest type are not confined to a few localities but have been found essentially of the same type over nearly the whole of the habitable globe, wherever they have been looked for, and the conditions are afvourable for their preservation. They have been found not only all over Europe but in North and South America, North and South Africa, Egypt, Syria, Mesopotamia, India, Mongolia and China, and reveal a distribution of the human race almost as universal as in historical times.

An Astronomical Standpoint.

If then it is possible to assign the causes of this glacial period, and to find among them one of an astronomical nature, which admits of calculation backwards in a definite number of years, we shall have very certain data, on which to assign an approximate date, if not for the first appearance, at any rate for the first certain knowledge of a wide distribution of the human species on the earth. Croll's celebrated theory professes to give us such an astronomical standpoint. It is an undoubted fact that the earth's orbit is not circular but elliptic, and that the eccentricity varies through long periods, making the aphelion portion of the orbit sometimes a little different from that of perihelion, and sometimes greatly in excess of it. At present the North Pole is turned away from the sun in perihelion so that in winter we are nearer the sun than in summer, and winter is shorter than summer. With the present nearly circular orbit the difference is not great, and probably insufficient to cause any very marked effect. But with a high eccentricity, when, with winter in aphelion in the northern hemisphere, the sun was six and a half millions of miles further from the earth than at present, and the winter was $28\frac{1}{2}$ days longer than the summer, it is scarcely conceivable that, if other conditions had induced a glacial period, its effects should not have been greatly intensified by such an astronomical cause, which existed more or less for a period of 160,000 years. It is true that the summers would then be hotter in proportion as the winters were colder, the absolute amount of heat received from the sun being uniform for the shorter and nearer, and for the longer and remoter divisions of the year. But the effects on climate would be very different, for the greater summer heat would be largely exhausted in radiation from a white surface, in melting masses of snow and ice, and in evaporation; while it would be intercepted by fogs and clouds, and diffused over the whole globe by aerial and oceanic currents. The increased winter's cold, on the other hand, would be fixed and stored up to a great extent by the conversion of water in its liquid forms of rain and sea, into the solid forms of snow and ice. It is difficult therefore to doubt that Croll's astronomical theory has been a *vera causa* of the Glacial Period.

Palæolithic Man.

Those who wish to pursue this interesting subject further will find it fully discussed in Wallace's *Island Life*, where it is shown that such geographical changes as have certainly occurred in eocene and miocene times, and in all probability in pliocene and quaternary periods, would account both for the former mild climates in arctic regions, and for the setting in of the glacial period with its vicissitudes of greatest cold and inter-glacial periods,

and how the effects of high or low eccentricity of the earth's orbit must have assisted and aggravated those changes, though acting over much longer periods than those of the precessional alternations every 10,500 years. Assuming this to be the case, which is the opinion of most modern geologists, it is evident that we have got an approximate standard for the duration of the glacial or quaternary period, and therefore for the existence of palæolithic man, whose remains are found throughout that period, of the fauna of which he is a characteristic member as much as the cave bear, the mammoth, and the woolly rhinoceros.

260,000 Years Ago.

The period of high eccentricity began 260,000 years ago, presumably towards the end of the pliocene; it rose to a maximum 210,000 years ago; then declined for 60,000 years; then rose to a second maximum lower than the first 100,000 years ago; and finally declined and passed into the modern period of small eccentricity about 60,000 years ago. These would correspond roughly to periods of 200,000 years ago for the first intense glaciation which covered Northern Europe with an ice-cap radiating from Scandinavia; 100,000 for the second great glaciation which did not cause an ice-cap, but brought great glaciers down from all highlands and mountains; perhaps 50,000 or 60,000 years for an inter-glacial period between these two maxima; and 60,000 or 70,000 for the post-glacial period since the second glaciation finally disappeared and the present equable and temperate climate was firmly established.

The Evidence of Submerged Forests.

It remains to see how far geological facts accord with this approximate scale of time. The first stage is the post-glacial, during which the physical geography, climate, fauna, and other essential conditions have remained substantially the same at present. There has been, however, during this period a number of changes in detail, which although inconsiderable compared with the great geological changes of former epochs, are in themselves of considerable magnitude. Thus the existing river drainage and sculpturing of the earth's surface into hills and valleys by denudation, has been done in a great part of Europe during this period. Much of the thick deposits which fill the great valleys of the north temperate regions must have been accumulated by tranquil deposits from the muddy waters caused by the melting of the ice and snow of the last glacial period. There certainly was a recent time when the German Ocean, and the Atlantic up to the 100 fathom line was dry land connecting the British Isles, Ireland, and all adjacent islands with the Continent of Europe, as is proved by the remains of submarine forests, which are found everywhere along the western coast from Brittany to Shetland. This forest-

covered continuance of the great plain of Northern Europe must have sunk down under the existing seas, and been again brought up by a slow elevation nearly to the present low water-mark. Since then there has been a slight depression of the British Isles of 20 or 25 feet, causing the raised beaches and inland sea-cliffs which are found along our shores, followed by a slight elevation which has brought sea and land to their present level.

Changes in Britain.

Now here comes in the value of the historical standard on which I commented at the commencement of this essay. It is certain that all those movements in Britain have been prior to the Roman period and to the time when tin was carted at low water across the spit connecting St. Michael's Mount with Cornwall, to traffic with Phœnician merchants. And what is more important, it is certain that where we have authentic records, as in Egypt and Chaldea, no change has taken place in the physical geography, the levels of sea and land, the climate, or the fauna for 7,000 years, and that these countries were then the seats of populous and civilized empires, with the types of the principal races of the human family and their distinctive languages, already firmly established. This is of itself a conclusive answer to those who invoke recent deluges and cataclysms, or otherwise attempt to compress the post-glacial period within such a limit as 8,000 or 10,000 years. Its actual duration can only be estimated from a careful and minute investigation of the changes, such as those above enumerated, which have actually occurred since the deposition of the latest boulder-clay, and of the time they must have required, starting from the fact that 7,000 years in Egypt and Chaldea, have been insufficient to make any marked change in existing conditions. Such an estimate has been exhaustively made by Mr. Mellard Read, of the Geological Survey, one of our best authorities on post-glacial geology, from the numerous pits and borings sunk in the valley system of the Mersey, and his conclusion is that 60,000 years is a probable estimate of the time required, a date which fits in remarkably well with that assigned by Croll, Geikie, and Wallace, from the combination of geological and astronomical causes to which they assign the vicissitudes of the glacial period.

The Vast Antiquity of the Human Race.

It is, however, from the glacial and inter-glacial periods that we gather the most striking proofs of the enormous antiquity of the human race. I need not refer at any length to the discoveries of what may be called the Boucher-de-Perthes period of palæontological science, which have firmly established the fact that almost everywhere throughout the old and new worlds rude human implements, connected with remains of extinct animals, have been

found in the gravels and silts of existing rivers, when they ran at 100 or 150 feet above the present and historical levels, and were just beginning to excavate their present valleys. Nor to the deposit of similar remains, often securely sealed under thick sheets of undisturbed stalagmite, in caves, which are the courses of underground rivers in limestone districts, which must have ran when the drainage and valley systems of the district were totally different from those at present existing. These are two well known to all who have the slightest acquaintance with geology to require any repetition, and I will confine myself to a few of the most striking and recent instances which carry to any unprejudiced mind the conviction of the immense duration of the quaternary period, and of man who is one of its most characteristic fauna.

The Lesson of the Chalk Cliff.

Dr. Evans gives a striking picture of what the palæolithic savages, whose implements are found in the gravels of the old Solent river now 100 feet above the present sea level at Bournemouth,must have seen looking southwards over what are now Poole and Christchurch bays. This old river has been traced by its gravels, sloping to the east, from the Dorsetshire Wolds, intercepting the small rivers, such as the Avon, Test, and Kennet, which ran into it from the north, and finally falling into the sea beyond Portsmouth. Such a river could only have run when the land extended beyond it to the south, and the sea was barred out by a continuance of the chalk downs between the Isle of Wight and Dorsetshire. The two extremities of this range at the Needles and at Ballard cliff, though now twenty miles apart, correspond like the two parts of an indenture, and show, by their outlying pinnacles or needles, the exact process by which the sea is gradually eating away a solid chalk cliff which has been upheaved so that the strata are nearly vertical.

Very Early Implements.

But a still more striking instance of extensive denudation has been just discovered,to which I refer with the more pleasure as it shows what good to science may be accomplished by societies like this,or even by single individuals who take an intelligent interest in this question. Mr. Harrison, a shopkeeper in the village of Ightham, in Kent, is also a field geologist, and spends a good deal of his leisure time in exploring the gravels of the chalk North Downs, and of the ridges of the Wealden, which bound the valley in which he lives. At various points in these grounds, at high levels far above those of the existing streams, he found a number of palæolithic implements, of a rude type but unmistakably of human origin. Having communicated this interesting discovery to Professor Prestwich, the Professor went down to the

spot, and after a careful examination of all the localities read an elaborate series of papers before the Geological Society which contained some remarkable results. The gravels in which these palæolithic implements were found are at heights far above those of the highest river gravels and watersheds of the existing streams, or of any which could have flowed with the existing system of drainage and configuration of the country. They rise gradually towards the south, and could only have been deposited when the area of the Wealden stood much higher and was drained by rivers flowing northwards. Moreover, these gravels are composed in great part of the *débris* of rocks, which are only found in the forest ridges of the great anticlinal of the Wealden. As water cannot flow up hill it is evident that this anticlinal ridge must have stood high enough to allow of streams, rapid enough when swollen by heavy rains or melting snow, to transport coarse gravel to the levels at which the present patches of this gravel are found containing the palæolithic implements. Knowing the gradient at which these gravels descend in their northward course, it is easy to estimate the height at which the anticlinal ridge and the intervening area must have stood to admit of such rivers flowing as they must have done. Nor is it difficult to estimate from the component of this gravel of the great southern drift the number and thickness of the strata above the present surface, which must have disappeared by denudation. Prestwich calculates the height of the summit of the ridge, which probably then formed a low mountain range continuous with the Ardennes, at 2,800 feet, so that about 2,000 feet must have been removed by denudation since the gravels were deposited. And he comes to the conclusion that this southern drift is in parts older than the Westleton pebble-beds, which, in Norfolk and Suffolk, lie immediately on the Red Crag, and have been generally considered as pliocene. It is unnecessary to say that Prestwich is the highest authority on this subject.

Patches of Gravel on the Southdowns.

The evidence has also been greatly strengthened by the subsequent discovery by Mr. Worthington Smith of similar gravels, at similar or even greater heights, on the chalk downs of Buckinghamshire and Hertfordshire. These gravels also contain palæolithic implements of the same type, some of which have been found *in situ*, under two or three feet of compact gravel. And here I may say a word to point out to the members of this Society the importance of examining closely the patches of gravel which occasionally cap the hills of the Southdowns at high levels. If the anticlinal ridge of the weald really stood at a height of 2,800 feet, as Prestwich says, it must have thrown off rivers from its southern as well as from its northern slopes, and traces of their drifts may be looked for at corresponding elevations. I believe that patches of such

gravel are found on the Southdowns similar in character to those examined by Professor Prestwich, viz., consisting of a tenacious brown clay with seams of sand and coarse gravels, and at about the same levels of height above the Ordnance datum line. I should earnestly advise any members of this Society who have the time and strength for pedestrian excursions to explore these gravels. It is very likely that they would be rewarded by finding palæolithic implements, and, in any event, good service would be rendered to science by collecting a mass of the gravel and ascertaining from what sources it was derived. If it turned out to be partly derived from rocks of the forest ridges of the Wealden, it would give an important confirmation to Prestwich's theory of an anticlinal mountain range 2,800 feet in height, which makes more for enormous denudation and extreme antiquity of the human race than anything that has yet been recorded in Britain.

The Argument from Denudation.

The average rate of denudation of continents, as shown by the amount of solid matter carried down by great rivers, is about one foot in 3,000 years. It is of course much beyond this average on the slopes of hills and when the strata are of soft materials ; but allowing it to have been even thirty times greater than the average in the case of the Wealden ridge, it would have taken 200,000 years to denude 2,000 feet. The difficulty is not so much to see how the denudation proved by Prestwich to have taken place can have required the interval of 200,000 years assigned by Croll and Wallace for the antiquity of the first great glacial period,as how it could have been compressed within that period,and whether it may not date back to the preceding period of a still higher maximum eccentricity, which occurred about 700,000 years ago. In Western North America we have proofs of a still greater denudation. The auriferous gravels of California, Oregon, and British Columbia, consists of an enormous mass of *débris* washed down by early glacial or pre-glacial rivers from the western slopes of the great coast ranges. During their depositions they became interstratified with lavas and tuffs from eruptions of volcanoes long since extinct,and finally covered by an immense flow of basalts, which formed a gently-inclined plane from the Sierra Nevada to the Pacific. This plane was attacked by the denudations of the existing river courses and cut down into a series of flat-topped hills divided by steep canons, and the valleys of the present great rivers. In one case, that of the Columbia river, this recent denudation has been carried down to a depth of 2,000 feet, and the river flows between precipitous cliffs of this height. Nearly the whole of the present gold mining is carried on by shafts and tunnels driven through superficial gravels and sheets of basalts and tuffs, to the gravels of those pre-glacial rivers, which are brought down in great masses by hydraulic jets. In a great

number of these cases stone implements, of undoubted human origin, have been found under several successive sheets of basalts, tuffs, and gravels, and in a few, as in the celebrated skull of Calaveras, human bones have been found under circumstances which it seems the height of unreasoning scepticism to dispute. Any doubt which might have existed as to the great antiquity of these gravels, and the human origin of the implements found in them, has been removed by a paper read recently before the Anthropological Society of London by Mr. Skertchley, the well-known geologist, to whom we are indebted for the discovery of palæolithic implements below the chalky boulder-clay at Brandon, in Suffolk. He visited California and brought back specimens of rude stone mortars of undoubted human origin, which were found in great numbers in a deposit of white sands and gravels, 450 feet thick, below a basalt cap varying from 25 to 100 feet in thickness. He says of those sands, "If the human remains had not been found in these geologists would never have doubted their tertiary age. At any rate they must be of immense antiquity. Since they were deposited the present river system of the Sacramento, Joaquim, and other large rivers has been established; canons 2,000 feet deep have been excavated by those later rivers through lava, gravels, and into the bed rock; and the gravels, once the bed of a large river, now cap hills 6,000 feet high."

Vast Accumulations of Mud.

The deposit of löess which fills up so many of the valley systems of Europe, Asia, and America to such great depths, and spreads over the adjacent table-lands, has always seemed to me a most conclusive proof of the great antiquity of the glacial period. It is a tranquil land deposit of fine glacial mud, from sheets of water which have inundated the country when the great rivers from glaciated districts ran at higher levels and gradually excavated their present valleys. Lyell estimates that the thickness of this deposit in the Rhine valley must have been at least 800 feet, admitting that the thin beds of löess found at much higher levels may be due to melting snow rather than to rivers. It is not marine, or lacustrian, but distinctly such a deposit as that of the Nile mud accumulated by annual inundations in the delta of Egypt. It is difficult to see how such an accumulation of fine glacial mud can have gone on faster than that of the Nile mud, which is estimated at about three inches per century. But at this rate 800 feet of löess would have required 320,000 years to accumulate, and a great deal of it is certainly posterior to the second or latter period of maximum glaciations. The difficulty here again is to see, not how the geological facts require the time assigned by Croll's theory for the phases of the glacial period, but how they can be compressed within such narrow limits. In any case it is certain that human remains, associated with a fauna of the early

quaternary epoch, have been found buried in this löess. The celebrated Canstadt skull, which has been taken as the earliest type of palæolithic man, was found in this deposit.

The Old World and the New.

To sum up the evidence as to the antiquity and origin of the human race afforded by the glacial period, it amounts to this. There is almost irresistible evidence to show that Croll's theory assisting still more powerful geological causes, was a real factor in bringing on the first glaciation of maximum intensity, following it by a long inter-glacial period, and rising into a second great glaciation which passed into existing temperate conditions when the high eccentricity passed away and the earth's orbit became nearly circular. But if so, it is absolutely certain that the first great glaciation must have occurred about 210,000 years ago ; the second 100,000 ; and the modern or post-glacial period must have set in about 60,000 years ago, unless indeed the first *maximum* glaciation occurred 700,000 years ago at the preceding period of still higher eccentricity. Now the palæontological evidence of thousands and tens of thousands of human implements and remains, makes it certain that, whenever this glacial period set in, it found the human race not only existing as part of the characteristic quaternary fauna, but existing over nearly the whole of the habitable globe. It is an incontestible fact that savages, manufacturing the same type of rude stone implements, were then living in the Old World from Spain and Britain to China and Japan ; and from England and the north of France to the shores of the Mediterranean, Egypt, and North Africa, and over the African continent down almost to its southern extremity at the Cape of Good Hope. In like manner in the New World they were living, from Ohio and California down to the Pampas in Buenos Ayres, and the plains of Patagonia. Consider what this implies. In the whole of the rest of the animal creation the existence of similar or closely allied species implies migration. Where this has been impossible in later geological times, owing to impassable barriers of deep oceans, even in narrow channels like the Straits of Lombok, or lofty mountains like the Himalayas, we find separate zoological provinces. No competent geologist doubts that if the same fauna substantially ranges over the whole Arctogeic Continent from the Atlantic to China, it is because the plains and steppes of Northern Europe and Asia afforded unbroken facilities for migration. And if North America has many species common to those, it is considered a proof that somewhere in the Tertiary ages there was a land connection with the Old World.

Science and Miraculous Creations.

On the other hand, countries like Australia and New Zealand have no representatives of the mammalian fauna of other regions,

because they have remained inaccessible to migration owing to deep ocean seas and channels of great geological antiquity. Now this which applies to the larger mammals must apply to man, unless we postulate separate miraculous creations,which hypothesis, as in the case of the animal and vegetable life, breaks down under the innumerable miracles which it requires. Thus in the case of one typical race only, the black, we require one ancestor for the dolicocephalic Negro with his frizzy and tufty hair, athletic frame and prognathous jaw ; another for the brachycophalic and pigmy Negritos of the Adamans and Indian Archipelago ; another for the Australians and savages of Van Dieman's Land ; another for the Hottentots and Bushmen, and so on for a number of different specific varieties. But if we assume the law of evolution and migration from one or a very few original centres of development to be true for man, as it unquestionably is for other mammals, what a long previous existence is required by the fact that palæolithic savages were chipping the same sort of stone implements at the same time in France and England, and in China, India, Egypt, and South Africa, and were spread in the New World from California to Patagonia. They could only have moved under the pressure of population on food, across plains and prairies, and along rivers and sea coasts ; and in passing between the temperate regions of the two hemispheres they must have traversed tropical regions where they could only have lived by a slow period of acclimatization. If there is one fact more certain than another it seems to be, that the widespread existence of palæolithic man, when we meet with his first traces early in the quaternary or glacial period, implies of necessity a long previous existence in tertiary times. And the direct evidence for this is fast accumulating.

A Notable Illustration.

In my "Problems of the Future," I have summed it up and shown that there are at least ten cases in which traces of tertiary men have been vouched for by competent geologists, and in which no doubt could have been entertained if they had been found in any quaternary strata. Time does not permit me to enter on the details of these cases, but I may refer briefly to one or two which seem to afford conclusive proof that man existed before the quaternary period. I take that of cut bones, for here there can be no question as to the tertiary nature of the bones in which the incisions appear. The balænotus is a well known pliocene fossil of an extinct species of whale. Specimens of its bones, with well-marked cuts, apparently similar to the cuts undoubtedly made by flint knives on bones of the mammoth and reindeer from caves of the glacial period, have been found in pliocene strata by well known geologists. They have been submitted to the scrutiny of the highest authorities in Paris, such as Quatrefages, Hamy, and

Mortillet, and pronounced to be unquestionably made by flint knives held by the human hand. Their conclusions are based on the most minute examination, which show: first, that the cuts are often in continuous curves or nearly circular, such as could only have been made by the free sweep of a hand. Secondly, that examination under the microscope shows that they present a clean cut which could only have been made by a sharp instrument on the outer side, while the inner side is rough and abraded, as would be the case in hacking the flesh off the bone with a rude flint knife. Thirdly, that those features are identical with those on the undoubtedly human cuts on the bones from caverns, and with those now made by way of experiment on fresh bones with old palæolithic flint knives. Nor is this the only instance. Similar cuts have been found on the bones of the Elephas Meridionalis from the gravels of St. Prest, which Lyell pronounced after personal investigation to be those of a pliocene river, and the implements found by M. Rames in pliocene strata at Puy-Cournay, in Auvergne, have been pronounced by the Congress of French geologists to afford undoubted proof of the existence of tertiary man. The human origin of the famous implements found by the Abbé Bourgeois in miocene strata at Thenay, was long questioned but is now admitted, and the only remaining doubt is whether they are really found *in situ* by competent observers or may not have been attested by the workman from the surface or from higher strata—a theory which was at first preferred against the discoveries of Boucher-de-Perthes, but which in that case is quite obsolete. The Italian discoveries of implements, and even of skulls and skeletons, in pliocene strata, seem to be well authenticated by careful and competent observers.

Conclusive Testimony.

But the new world would almost seem to be the old one, in the sense of supplying the largest and most conclusive evidence of the extreme antiquity of man. The human remains and implements which have been found in such numbers, and in so many places, in the auriferous gravels of California, all lie beneath the basaltic cap. The animal remains which are abundantly found beneath this cap are all of extinct species, including the auchenia and hipparion, and others entirely distinct from those that now inhabit any part of the North American continent. The hipparion alone seems conclusive as to the tertiary age of the deposits, for it carries the ancestral line of the horse one step further back than when the fossil horse first appears on the quaternary age. The vegetable remains found in the volcanic tuffs interstratified with the gravels beneath the basalt cap confirm this conclusion, for they are all distinct from the existing vegetation, and are considered by Professor Lesquereaux to be pliocene with some affinity to miocene. The latest discovery, quite recently made in

this geological horizon, is one of extreme interest. It is that of the Nampa image brought up in boring an artesian well, in Ada County, Idaho, through a lava-cap, 15 feet thick, and below it about 200 feet of the quicksands and clays of a silted-up lake, formed in a basin of the Snake river which joins the Columbia river, and flows into the Pacific, forming part, therefore, of the same geographical and drainage system as the Californian gravels. At this depth the borer came down to a stratum of coarse sand, mixed with clay-balls at the top, and resting at the bottom on an ancient vegetable soil, and the image came up from the lower part of this coarse sand. The borer, or liner of the well, was a six-inch iron tube, and the drills were only used in piercing the lava, while the sands below it were all extracted by a sand-pump. Mr. Kurz, a respectable citizen of Nampa, who was boring the well, states that he had been for several days closely watching the progress of the well and passing through his hands the contents of the sand-pump as they were brought up, so that he had hold of the image before he suspected what it was. Mr. Cumming, superintendent of that portion of the Union Pacific Railway, a highly-trained graduate of Harvard College, was on the ground next day and saw the image, and heard Mr. Kurz's account of the discovery; and Mr. Adams, the president of the railway, happening to pass that way about a month later, brought it to the notice of some of the foremost geologists in the United States, from an article by one of whom, Mr. G. F. Wright, in the *Century Magazine*, this account is taken. The image was sent to Boston by Mr. Kurz, who gave every information, and it was found to be modelled from stiff clay, like that of the clay balls found in the sand, slightly, if at all, baked by fire, and incrusted like these balls with grains of oxide of iron, which Professor Putnam considers to be a conclusive proof of its great antiquity. Mr. Emmons, of the State Geological Society, gives it as his opinion that the stratum in which this image is said to have been found is older by far than any others in which human remains have been discovered, unless it be those under Table Mountains, in California, from which came the celebrated Calaveras skull. So much for the authenticity of the discovery, which seems unassailable; but now comes the remarkable feature of it, which to a great extent revolutionises our conception of this early palæolithic age. The image, or rather statuette, which is scarcely an inch and a half long, is by no means a rude object, but on the contrary more artistic, and a better representation of the human form than the little idols of many comparatively modern and civilized people, such as the Phœnicians. It is, in fact, not unlike the little statuettes which are found in the earliest remains of Egyptian or Chaldean art, as anyone may judge who cares to stay when the reading of this paper is concluded, and look at the drawing on a page of the magazine from which this account is taken. But if

this be so, to what an enormous antiquity must it throw back the existence of man in this region of the western slopes of the Rocky Mountains and Sierra Nevada towards the Pacific ; and how is it to be reconciled with the universal experience from all other parts of the world, that the further we go back in palæolithic antiquity the ruder become the implements, and the more unmistakable the evidence for the savage and animal-like conditions of the earliest races ?

An Interesting Paragraph.

As I wish to post you up with the latest information bearing upon this interesting subject, I will conclude by reading to you a notice which appeared within the last few weeks in the *Times* newspaper, and for which I am unable as yet to give any confirmatory evidence, though I see no reason to doubt that such a discovery has really been made, and, if so, the finding of two skulls of an exaggerated Neanderthal type, in the lower of three distinct strata, would be an important step in the direction of the missing link.

Primitive Man.—Two Liege *savants*, MM. Marcel de Puydt and Maximilian Lohest, have announced a recent discovery which may be of scientific importance. In a cave at Spy, a few miles from Namur, known as the Biche aux Roches, they found in the sandstone two human skulls of extraordinary thickness resembling the celebrated skull found in the Neanderthal, near Elberfield. They have the same very projecting eyebrows, and the same low sloping forehead of a decidedly simian character. The finders suggest that these are types of the skulls of the primitive race who dwelt on the Sambre. Three layers of the sandstone were plainly discernible. It was visible that the remains of flints, &c., deposited in each layer indicated different stages of skill in workmanship. The lowest stratum was by far the poorest in the number of the objects found and in the quality of their workmanship. But it was here that the skulls were found, so that from a scientific point of view it is most important.

Confirmation by Professor Huxley.

Since writing the above, Professor Huxley has published an article in the *Nineteenth Century* of this month confirming these discoveries at Spy, and giving some interesting details. He says the men whose skeletons were found were "short of stature but powerfully built, with strong, curiously-curved thigh-bones, the were / lower ends of which ~~was~~ so fashioned that they must have walked with a bend at the knees. Their long depressed skulls had very strong brow ridges ; their lower jaws, of brutal depth and solidity, sloped away from the teeth, downwards and backwards, in consequence of the absence of that peculiarly characteristic feature of the higher type of man, the chin prominence." Mr. Fraissaint,

one of the discoverers of the Spy Cavern, who is an eminent anatomist, thus sums up the evidence afforded by those skeletons. "The distance which separates the man of Spy from anthropoid apes is undoubtedly enormous; between the man of Spy and the dryopithecus it is a little less. From the data now obtained it is permissible to believe that we shall be able to trace the ancestral type of man and the anthropoid apes still further, perhaps as far as the eocene and even beyond."

Brighton & Sussex Natural History and Philosophical Society.

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1891-1892.

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SESSION 1890-1891.

WEDNESDAY, OCTOBER 8TH, 1890.

INAUGURAL ADDRESS

BY

MR. GEORGE DE PARIS,

(PRESIDENT,) ON

THE PRESENT STATE AND FUTURE PROSPECTS OF THE SOCIETY.

LADIES AND GENTLEMEN,—

Having been honoured with the office of President for another year, it becomes my duty to review the proceedings of the past Session, and bring the result to bear upon our prospects for the year before us.

I may sincerely congratulate the Members on the pleasant evenings we have spent together and on the excellent papers that have been read by MR. and MISS CRANE, MR. REAN, MR. H. DAVEY, MR. PANKHURST, and DR. NEWSHOLME, and also on the instructive discussions that have sprung from them; and I may, I feel sure, thank (in the name of the Society) those who have so kindly and so ably assisted us. I am sure, too, that many of us will always retain a pleasant memory of the excursions in which they have taken part, the charming Sussex scenery they have visited, and the genial hospitality that has been experienced, particularly at the Rectory at Amberley.

But while I gladly allude to these pleasant aspects of the past, I should be wanting in a proper regard to the interests of the Society over which I am called to preside, did I not glance at its less promising features, and indicate as far as possible the reforms which must take place among us before we can fairly lay claim to the name and prestige of a successful Institution.

If the small circle of tried friends who meet here constituted the whole of the Society; if the papers read here emanated from a large proportion of its Members; then we might challenge comparison with far more pretentious bodies.

But we know that it is not so. We know that some of our best papers have been contributed by non-Members; that of the large number of Members whose names appears on our books, not a score attend our regular Meetings, and not half-a-dozen contribute papers, while our Field Excursions attract but few Members, and sometimes even an Excursion falls through altogether, a single Member only making his appearance, as was the case on the day of the last Field Excursion of the season.

In the hope that I may be able to suggest some means of remedying these undoubted evils and adverse influences, I will, with your permission, consider each separately.

The first in point of importance appears to me to be the small attendance at our regular Meetings; for if Members are not sufficiently interested in the Society to attend its Meetings, it is hardly to be expected that they will give themselves the trouble to contribute by their own labour and research to its usefulness or to the acquisition of fresh knowledge.

Therefore, if we wish to infuse a warmer interest in our proceedings and secure the frequent attendance of a large proportion of Members, it becomes absolutely necessary that we should make our Monthly Meetings attractive, and past experience plainly shows that for this we cannot rely solely upon our Members. I mean, that many valuable papers read at our Meetings are naturally highly scientific in their character and aim, and abound in technicalities which can only be appreciated by those Members whose constant reading and well-trained minds enable them to follow the abstruse points and sequence of ideas developed in an argumentative paper. Want of familiarity with these technicalities, or perhaps even the elements of scientific knowledge, deprives the hearer of the key which would unravel the mystery of phrases which contain the pith of the argument. Thus, while a few can grasp the structure of a scientific paper and readily follow the Lecturer, others obtain only a very slight knowledge of isolated facts, which stand out more prominently on account of their simple or more striking development. Let me not be understood as advocating the introduction of papers on elementary knowledge and the extinction of scientific papers, but I would urge that high class essays should be supplemented by the occasional services of distinguished specialists, who would instruct and delight the Members upon popular and favourite subjects. The funds of this Society could not be better employed than in thus disseminating a knowledge of the various

branches of Natural History, particularly if such lectures were well illustrated by striking diagrams presented vividly to the audience by the aid of lime-light. Such lectures would attract the whole body of our Members, and be the means of awakening a keener interest in natural phenomena and the wonders of creation which are scattered around us, ready to yield their scientific secrets to the earnest investigator.

If it be true, as has been said, that "Science is measurement," it is no less true that "Science is statistics." For instance, a carefully tabulated statement of the daily rainfall, the prevailing winds, the succession of wild flowers in a given area, the migration of birds, or the deposition of beach behind a groyne, would afford valuable material for a paper, and the patient observer would hardly fail to have gathered useful experience or to enrich his contribution with thoughtful deductions.

But to bring these reflections to a practical issue, with a direct bearing upon what I believe to be the *secondary* important cause of the adverse influences which have affected the attendance of Members at the Meetings of late years, I would venture to point out a way by which the Members of this Society might render most valuable service to the scientific world, and at the same time kindle within themselves a burning thirst for the acquisition of special knowledge, which has hitherto been beyond their reach, for want of superior guidance or sympathetic help in their studies.

I would suggest that we should form ourselves into a series of what may be called "Scientific sub-Committees," or separate and distinct groups, each representing a different branch of Natural History, and each composed of such Members who feel a special interest in a particular study. Each of these "sections," working on a systematic and pre-arranged plan, would do for its own branch the same sort of work that our talented friend, Mr. F. E. SAWYER, has done for the Meteorology of our County. From time to time each section would be expected to bring up a report recording their observations on the fauna and flora, the geology, and mineralogy of some portions of Sussex; and such reports would, I feel convinced, form most interesting subjects of discussion, with this additional advantage, that all the Members of that section would attend the reading of their report or paper, and attract also the presence of many others, by reason of the animated discussion which would arise upon a subject which had been investigated and mastered by several of those present. Such reports would be of lasting use; the more so, because the vicinity of Brighton has been a favourite habitat of flowers and animals seldom or never found elsewhere.

Thus, in the department of Botany alone, we have the starry-headed clover *(trifolium stellatum)* at Shoreham, and the spiked

rampion *(phyteuma spicatum)* at Buxted, neither of which are found anywhere else in the United Kingdom, while it would be interesting to know whether the Adonis still haunts the vicinity of Rottingdean, or whether the smooth spleenwort *(asplenium fontanum)*, once seen at Petersfield, has ever re-appeared.

In like manner, to the Ornithologist and to the Entomologist such researches would be of the highest value.

Further, I am strongly of opinion that it would add much to the interest of such reports from a section, if they were, if possible, accompanied by collections of specimens illustrative of actual facts. The fullest particulars should be given—the exact locality, the time of the year, and, in many cases, the natural surroundings. As regards this last point, I may instance the immense educational value imparted to the Booth Museum of Birds, now the property of the Town, by the faithful representation of the peculiarities of the surroundings connected with the localities from whence the birds were obtained.

I will hazard yet another suggestion, for the sake of those who, while unable or unwilling to devote themselves to the study of any special branch of Natural History, would yet desire to know something of the marvellous objects which everywhere meet his gaze. Such an enquirer placed, for instance, on our beautiful Brighton beach, can derive little information from the volumes he finds in our Library. The shells demand a knowledge of Conchology; the sea weeds belong to Cryptogamic Botany; the sea mats (Sertularia), jelly fish, hermit crabs, and limpets must be studied in the treatises on the Polyzoa, the Zoophytes, and the Mollusca; while the Cliffs, with their long lines of flints, their "raised beach" and "elephant bed," belong to several geological periods. A paper on this subject—popular without being superficial and scientific without technicality—would be of the greatest use to many of us, and would consequently attract many to our Meetings, who would fail to understand a purely technical discourse, while the character of the Society would be rather raised than lowered, in awakening a truly scientific interest in objects which, for want of such information, have hitherto passed unregarded and totally unthought of.

How to infuse greater vitality in our work is the problem we have to solve, and I believe that if we direct our attention to the necessity of organizing a series of weekly or fortnightly Field Excursions during six months of the year, we shall be on a beaten track which will be productive of the desired results.

If these Field Excursions are merely considered as a pleasant "outing," they will never be well attended. To render them attractive they should have a definite purpose in view, and be conducted by a Member who knows the vicinity and its

peculiarities. Such an excursion should be distinctly geological, botanical, or zoological; the special branch of research should be made known beforehand to each section or group, so that each Member may be prepared to take his part in the actual work of that day under the direction of the Member in charge of the party. This would mean real work, and the steady pursuit of knowledge, instead of the discursiveness which has hitherto prevailed at these Field Excursions and, as true knowledge systematically acquired is said to be its own true reward, so we may safely assume that private study will follow the discovery of some botanical specimen, the unearthing of fossils—crustacea—or the capture of fine specimens of insect life.

It is, I consider, distinctly a loss to the Society that those reports of our Meetings, which used to be given by the Press, no longer appear. It is to be hoped that, for the benefit of the Society, some account of our proceedings will again find a prominent place in the daily and weekly journals of the town.

Lastly, I wish to make some observations with reference to the Annual Excursion of this Society. Since its foundation an opportunity has been offered to the Members to visit some interesting spots in Sussex, which possessed special features of interest to the Naturalist, the Geologist, and the Archæologist. The early part of July has been the time chosen on account of the length of day, and also because the scenery of this county is seen at its best in that month. The attendance of Members has been fitful; sometimes a fair gathering has been obtained, at others a very small proportion of Members expressed their intention of being present. Last year great care was taken to select a locality which it was thought would attract a large attendance, and yet the actual outcome was a party of barely a score, even including visitors and reporters. Was this due to indifference or thoughtlessness, or an unwillingness to give up one day to the pursuit of knowledge or social recreation?

But it was a source of vexation to find that the best efforts of the Executive could not secure a larger attendance than eighteen at dinner. I earnesly hope that this indifference or heedlessness will be swept away in the future, and that the Members will feel that they have sadly neglected the obligation devolving upon them of supporting the Society to their utmost.

In contrast with this state of things, let me mention the success which invariably marks the Annual Excursion of the Sussex Archæological Society, at which from one hundred to one hundred and thirty members and visitors invariably assemble to honour the occasion, and enjoy the papers which are read on the ancient churches, or domestic buildings at which a halt is made, and yet the cost of that Excursion is somewhat in excess of that of the Natural History Society.

Is this success to be attributed to the reading of special papers on that day? If so, let the Natural History Society follow the example, and at our next Excursion let three or four Members be duly prepared with papers having special reference to the locality we may visit.

I have now touched upon all the causes of failure or lukewarmness which have presented themselves to me during a year of office as President, and I trust that I have done so without giving offence to any. My desire has been to show what I think is weak in the work of this Society and to suggest a remedy. Our desire above all things should be to promote familiarity with Natural History and kindred branches, to urge the Members to take a warmer interest in our proceedings, and to remember that, when we have made ourselves acquainted with elementary truths, we are expected and encouraged to extend our researches into the hidden mysteries of Nature and Science, and to become skilful and learned Members of the Natural History and Philosophical Society.

WEDNESDAY, NOVEMBER 12TH, 1890.

THE ANTIQUITY OF MAN,

BY

MR. SAMUEL LAING, F.G.S., &c.

(Given in the King's Apartments, Royal Pavilion.)

As a copy of this paper *in extenso* is sent, through the courtesy of the Author, to each Member with this Annual Report, no abstract of it has been made.

WEDNESDAY, DECEMBER 10TH, 1890.

THE DEVELOPMENT OF THE FLOWER,

BY

MR. E. F. SALMON.

In bringing this subject before the Meeting, the author first commented on the reproduction of its kind as being the supreme effort of the plant, all growth from the emergence of the young plant from the seed until it is itself a seed-producer tending towards that end; the successive stages of growth which take place in the Plant ultimately culminating in those which collectively form the Flower, in which the seed is reproduced.

Mr. Salmon then alluded to the sub-divisions of the Vegetable Kingdom, briefly pointing out the structural differences of Mono and Di-cotyledonous plants. Attention was next drawn to the well-established fact that all parts of a plant, even those differing most widely when fully developed, are referable to a few original forms, viz, : *Phyllomes* or leaf-structures, *Caulomes*, or stem-structures, *Trichomes*, outgrowths of epidermal cells, such as hairs, &c., and *Thallomes*, structures in which the distinction of stem, leaf, and root is not perceptible, seaweeds for example. To illustrate how the component parts of the flower are modifications of the typical leaf organ (Phyllome), being ulterior developments, Mr. Salmon proceeded with the aid of diagrams to describe the structure of seeds, taking examples from both Mono-cotyledonous and Di-cotyledonous plants, showing that the fully developed embryo contained within consists of the principal parts of a matured plant, but, of course, in a rudimentary state.

Notice was then directed to the germination of the seed, the growth of the young plant, the gradual development of its leaves, and an allusion made to the "growing point," in order to explain the process of growth. The appearance of bracts on the stem, with development of the inflorescence, came next in order; the parts of the flower were severally described, and each compared with the typical leaf, examples being given of how one organ may be the homologue of another. Special attention was directed to the ovules, their fertilization, and development, by which they become seeds, the fruit produced, and the reproduction of the plant ensured.

Mr. Salmon concluded as follows: We have now gone through in succession the stages of growth in the order of their occurrence, from the planting of the seed until the reproduction of the same, and what I hope to have made clear is, that the development of the flower with the production of the seed is provided for from the very first, and may be said to be the result of adaptation to circumstances of the typical foliage organs which we call "Phyllomes." They are first seen in the embryo plant as the plumule, then (as in the bean) they appear as scales, gradually in this example working up to the pinnate and stipulate variety of leaf; in due time bracts appear, being another departure, then come sepals, petals, stamens, and carpels, all developments of one typical leaf (not metamorphoses, because that implies change of one thing into another, which is not the case here), and which development can, if necessary, take the form of tendrils, spines, or other forms necessary to the economy of different species.

Necessarily only main points have been brought forward. Many proofs have been neglected, and exceptions unnoticed; nor has any mention been made of abnormal growths, in the study of which abundant instances of the replacement of one organ by another occur, tending very materially to show the common origin of the different organs of plants.

WEDNESDAY, JANUARY 13TH, 1891.

EVENING FOR SPECIMENS.

WEDNESDAY, FEBRUARY 11TH, 1891.

WILD AND DOMESTICATED ANIMALS PHOTOGRAPHED AND DESCRIBED,

BY

MR. GAMBIER BOLTON, F.Z.S.

MR. GAMBIER BOLTON, in opening his lecture, and before exhibiting the specimens which he claimed to be the first serious attempts made to combine artistic and scientific qualities in photographs of animals, explained the enormous difficulties attending the work which he had been engaged in, difficulties of which the portrait, landscape, and hand-camera photographer knew nothing —a puff of wind moving the mane, tail, or feathers; the slight sound causing the twitching of an ear; the quick action of the eye and nostrils, or even the movement necessary in breathing, spoiling hundreds of otherwise perfect plates, many of them taken only after hours, and in some cases even days, of watching. It was quite a common occurrence, he said, to use thirty to fifty plates on a single animal or bird, and in some istances nearly one hundred plates had been exposed and developed before the one *perfect* negative had been obtained. From this they would see that a good deal of patience was required—some would call it obstinacy; anyhow, a determination not to be beaten, but to return to the task day after day until the result satisfied you. A natural taste for, and some idea of, zoology, and a certain amount of artistic training, were also necessary before the proper positions for the various subjects could be selected—positions that would please and satisfy naturalists, artists, and the general public. The scientist cared little for picturesqueness and happy expression; he wanted Nature, and as far as possible in profile. The artist wanted Nature at her best; and the lion yawning, or the tiger suffering from influenza, had no charms for him. But the public he had found quick to appreciate their efforts, and would often take up a photograph that would sell more quickly than it could be printed.

He condemned the general use of instantaneous photography in the case of animals as of little or no use to the scientist or the artist. It required a strong light, and gave consequently strong shadows with little detail. Slow plates should be used, and the exposure should be one of at least two

seconds, so as to bring out the detail. Of course this greatly increased the difficulty. Such animals as tigers and bears were hardly ever quiet in captivity, but were engaged in a sort of go-as-you-please competition, which had made it considered as reasonable to expect to take such an animal standing as to fix an elephant's head in a rest and ask him to look pleasant. Some animals got frantic at the sight of the camera, especially the lens, as they thought it a great staring eye. Animals did all they could to frustrate the photographer by making themselves as unpicturesque as possible, and were by no means willing sitters. Of the value of the work when done he said that animals and birds that are useless to man have had their day, had already reached and passed their zenith, and the time was not far distant when photographs of many of these would be sought after, and, like a really good large photograph of the quagga or dodo to-day, would be almost priceless, for following these they had many such as the bison (American and European), zebra, giraffe, and hippopotamus fast disappearing before the march of civilisation, and it could only now be a question of a comparatively few years before they, too, became extinct, and paintings, and, above all, photographs, would alone shew what they were like.

The Lecturer commenced the exhibition of slides with one specimen of how not to do it. The figure was that of a lion standing behind the bars of his cage, and the whole picture the Lecturer neatly summed up by remarking that beyond a nose and a few hairs there was absolutely nothing but a very fine study of iron bars. The slide, he was informed by the maker, had been sold by thousands, and was used all over the civilised world with lecturers as an example of what the king of beasts looked like. The hand-camera and instantaneous school were, he said, particularly fond of those negatives, one of them observing to him last year that he thought the bars gave a greater idea of the animal's ferocity and strength. He forgot to add that he could not possibly photograph them without the bars, as he was not permitted to get inside the outer enclosure at the Zoological Gardens. The Lecturer's idea of how to do it was a magnificent view of a lion, standing, and without the bars, a photograph which he said was the result of a week's study of the animal's habits. Another photograph shewn, also unique in its way, cost him about fifteen hours' waiting at the cage, three days of five hours each. Of the difficulties attending the taking of a group of lion cubs, he said they were so inquisitive when they saw the camera they almost sat down on it.

A series of photographs of tigers followed, and of one of these the lecturer said after taking it he had his head under the cloth to take another, when the animal sprang upon him,

and were it not for the shriek of a child warning him of the danger he would probably not have survived. He had seen some strange things on the plate of his camera, but nothing like that sudden flash. At another time he took hold of one end of the apparatus and a tiger of the other, and he only induced him to let go by sending clouds of tobacco smoke into the beast's face. The tiger series included some magnificent photographs, which were loudly applauded on being put on the sheet. Leopards also were the leading figures in some of the finest pictures shewn. The Lecturer described them as by far the most difficult of all the carnivora to take in a standing position and in a dull light. Photographs of the jaguar, the Polar bear, the sea lion, and of elephants followed Alluding to the difficulty of taking elephants, he gave an anecdote of an elephant he was required to photograph. It had lately been covered from head to foot with oil, and no sooner was it brought out into the light than it was covered with flies, and tail and trunk busied themselves removing them. After spending three days over the animal, and wasting a great number of plates, he was obliged to resort to instantaneous photography. The rhinoceros, the tapir, and zebras were the subjects of a great number of slides, and camels, hippopotami, bisons, wild cattle, antelopes, and giraffes followed. Photographs of wild kangeroos were shewn, over which the Lecturer said he had wasted 180 plates, and only obtained good negatives by going along the grass like the old serpent, dragging his camera behind him, and gradually raising it when a favourite opportunity occurred.

After shewing an extremely interesting series of photos of wild birds, he animadverted on the efforts of the average photographer in taking domestic animals. He said in Brighton he had been through the streets to see what sort of work was to be found in the shop windows, and it was the old story, rows of dogs' heads, lacking expression as much as they do bodies —dogs and cats lying down in sleepy positions or sitting up, looking like wooden dummies ; horses and cows with three legs and a smudge representing the tail or ears, all with the scared look that tells of the assistant not far off, waving a handkerchief or clapping his hands, or taken at such an angle that the heads were large enough for elephants, whilst the bodies faded away into the distance, " fine by degrees and beautifully less." It was an amusing to enter with a dog and say in a quiet way that you wished him taken standing, and above all with his tail up. The innumerable excuses that would be invented, the old, old story that heads were so much more fashionable and artistic, that they looked so natural when lying down or sitting up, anything, in fact, but standing, and above all, without that exasper-

ating caudal appendage raised. Of course there are very rare instanees where it was right to take only a head, for instance, when the body was badly shaped, deformed, or injured ; but these were very exceptional circumstances, and he would, therefore, urge the professional photographer the wide world over to look to this matter at once, and try to introduce a little more life and expression into his animal photographs, particularly into those of the horse, dog, or cat. The Lecturer closed with the exhibition of a fine series shewing how to do it.

WEDNESDAY, MARCH 11TH.

OBSERVATIONS AND EXPERIMENTS ON THE MARKINGS AND COLOURING OF LEPIDOPTERA AS AFFECTED BY TEMPERATURE,

BY

MR. F. MERRIFIELD.

In some experiments with English moths, lately instituted on the suggestion of Mr. Francis Galton, connected with that gentleman's researches in heredity, the author had been led to follow up certain collateral lines of investigation as to the relations between climatic conditions and the markings and colouring of Lepidoptera, a subject of some interest in its bearing on recent geological history. Mr. W. H. Edwards, in America, and Prof. Weismann and others, in Germany, had shown that, by subjecting the pupæ of certain butterflies, known for their "seasonal dimorphism," to a low temperature, the Summer form could be converted, or nearly converted, into the very different Winter form, but that the endeavour to obtain the converse result always failed. Weismann's theory was that the Winter form was the ancestral one, and that as the glacial period gave place to a warmer and longer Summer, the second or Summer brood was interpolated, and had a tendency, when subjected to a low temperature, to revert to the old form. Mr. Merrifield's experiments on some English seasonally dimorphic

germative moths, notably *Selenia Illustraria*, confirmed thesc results in the main, but established some results which Weismann's explanation did not cover. They proved that, by warming the pupa of the Winter form shortly before its emergence, the perfect insect could be made in colouring, but not in marking, to approach the Summer form, also that certain single brooded species, *e.g.*, *Ennomos Autumnaria* had their colouring much affected by temperature at their late pupal stage. In both the species experimented on the tendency of the lower temperature was to cause a darker colouring. The difference in appearance caused by the temperature applied was often conspicuous, and a range between 57° and 80° Fahr. was sufficient. A "warm atmospheric wave," coming in and lasting for only a few days, if it happened to come just at the right stage of pupal development, could not fail to affect the colouring of some species in a state of nature. He thought it probable that some supposed climatic or seasonal races would prove to be in fact temperature varieties of the individual, and on the now generally accepted view that the changes which an individual went through in its embryonic stages were an epitome of the changes the species, genus, or family had gone through in the course of its evolution, experiments of this kind, if Prof. Weismann's theory of reversion were accepted, might throw light on the process of evolution of the complex markings and colouring of the wings of some of the Lepidoptera. The change in markings appeared to require a lengthened application of temperature during the earlier pupal stages, whereas the change in general colouring was caused by a comparatively brief exposure during the penultimate stage, *i.e.*, that immediately preceding the last stage of all, in which the colouring of the perfect insect can be seen through the semi-transparent pupa case. Applying the knowledge gained by his experiments, he had obtained from the same batch of eggs of the Summer brood four forms of the perfect insect, viz.: (1) Summer markings and colouring; (2) Summer markings and Winter colouring; (3) Winter markings and colouring; and (4) Winter markings and Summer colouring; and he exhibited specimens and enlarged coloured photographs of each.

WEDNESDAY, APRIL 15TH.

THE EVOLUTION OF THE SOLAR SYSTEM,

BY

MR. E. J. PETITFOURT, B.A.

Assuming the Solar System to have originally existed as a nebulous mass of vast extent, how far would the evolution of the Nebula in accordance with the laws of nature produce the complex aggregate of phenomena now exhibited by the Sun and its attendant planets? The answer may be summarized as follows:—

In the first place the Nebula was subject to radiation of heat and to contraction, with the almost inevitable accompaniment of a rotatory motion which increased in velocity as contraction proceeded. A spheroidal form was thus imparted to the mass, and a maximum of centrifugal force was developed at the equator, likewise increasing with time, until, overbearing the central attraction of the Nebula, it checked the further contraction of the equatorial parts, and a ring became detached and left behind. A series of nebulous rings was thus formed, until contraction had so far advanced that the centripetal force could no more be overcome, and the nucleus, settling down, ultimately became our luminary, the Sun. These rings meanwhile coalesced to form the planets, all following the same direction of revolution as that originally imparted, and with increasing velocity from the outer to the inner planets.

These considerations, together with the augmented density of the Nebula at each successive stage and the differences in the magnitudes of the orbits, lead to the conclusion that a series of large planets, ascending in magnitude, followed by a descending series, should be formed, which is fairly the case in the Solar System; and there seems to be a similar tendency in that of the moons of Jupiter and Saturn, which may be considered as having originated from rings on the same principle as above.

The densities of the planets can be deduced from the following principles:—1. The inner rings were of denser materials. 2. Radiation and contraction were more rapid in the smalier planets. We should therefore expect to find an ascending series of densities. This is the case, except (*a*) Saturn. This is perhaps

due to the heat generated by its coalescence, which must have been much greater than that produced in Jupiter, whose orbit is much smaller. (*b*) Venus, whose irregularity is slight.

The distances of the planet are approximately represented by the regular series of numbers known as Bode's Law. If the actual distances be reduced in the same proportion, so that the number for Neptune is the same as in Bode's Law, and the two sets of numbers be compared, it will be found that all the deviations from Bode's Law are outward, which the attraction of the outer planets would account for. In the case of the Asteroids the deviation of the outermost is 57° outward, while the innermost has no deviation to speak of. This is significant, and it would seem that the enormous attraction of Jupiter broke up the next ring, and instead of one planet a large number of small planets with intersecting orbits were formed. The next planet with marked deviation is Venus, this being probably due to the combined attractions of Jupiter and the Earth. Planetary attraction cannot, however, explain the high deviation of Uranus.

Owing to the increasing obleteness of the Nebula as time went on, the thickness of the successive rings must have been greater in the direction of the equatorial plane in comparison to the thickness in a direction vertical to it, but the problem is further complicated by the masses and magnitudes of the rings. The tendency of a comparatively flat ring would be to form a planet with slight axial inclination. So far as these inclinations are known, fact agrees with theory, except in the cases of Neptune and Venus.

Rate of rotation, *i.e.*, the length of a planet's day, would depend upon the difference in velocity between the outer and inner parts of the ring, and the planets whose rate of rotation is known, have a length of day in excellent accord with mathematical calculations.

The contraction of the Nebula would in all probability produce a periodic oscillation of its axis in addition to rotation; the original rings being thus detached at various angles to the plane of the Nebula's equator, the present inclinations of the orbits to the ecliptic would be accounted for. This explanation is, however, insufficient with regard to some of the minor planets *e.g.*, Pallas, with an inclination of 34° to the ecliptic, and there is a further difficulty at present unexplained, viz.: how is it that Jupiter's attraction has not yet dragged these asteroids into a more level position.

The retrograde motion of the satellites of Uranus and Neptune is probably accompanied by a similar motion on the part of their primary. This peculiarity seems difficult to account for, but calculations show that the rings of these two planets must have been very thin and belt-like, and a retrograde motion

is not at all inconsistent with the behaviour of such rings as a consequence of their coalescing.

Saturn with its eight satellites and a ring-system is a specially remarkable example, if, according to the Nebular Hypothesis, these latter also arose from rings. The ring-system is what is left to us of Saturn's ninth nebulous ring, which has spread and become flattened in process of time, and the inner parts of which seem destined to fall into the primary, while the outer parts will become detached and finally coalesce to form a ninth satellite. That this satellite should not have been formed from the first is explained by the proximity of the ring-system to the primary, in consequence of which the opposing centrifugal and centripetal forces were so powerfully developed that the ring was broken up and an enormous number of diminutive bodies were formed instead.

As for the comets, it is probable that the majority of those which have closed orbits were outlying clouds of the original nebula, which were never attracted into the main system.

In conclusion, ocular demonstration alone can transform this hypothesis into a law, and the nearest approach to ring-evolution is found in Saturn's system ; but, although it may take years to prove or disprove this grand conception, further advances in Astronomy seem rather to confirm than refute the leading arguments of the theory, and for the present, at any rate, these may at least be accepted as "pegs on which to hang our facts."

WEDNESDAY, MAY 13TH.

THE AURORA BOREALIS AND ALLIED PHENOMENA,

BY

MR. W. H. REAN, M.R.C.S.

Among the grand and sublime phenomena of Nature few have excited greater wonder and awe among the unlearned, or furnished deeper study for the scientific, than the Aurora Borealis. Having quoted a graphic description of the Aurora from the

writings of Tromholt, the author proceeded to discuss the following problems connected with it: —Firstly, the geographical distribution; secondly, its height above the earth; thirdly, the meaning of the regular formations observed in the phenomena it displays; and, fourthly, as to the cause of the colour and the variations of it which give it such beauty.

1. As to the geographical distribution. It is well-known that the Aurora increases in frequency and intensity as we leave the equator and approach the poles. But in the Northern Hemisphere, Professor Fritz, of Zurich, has shown that there is a maximum zone. This runs from Point Barrow over Great Bear Lake to Hudson's Bay, over Main on the coast of Labrador, south of Coast Farewell in Greenland, between Iceland and the Faroe Islands, across the Lofaden Islands, the North Cape, north point of Nova Zembla, and south of Wrangel-land. During the dark season in this zone the Aurora is a phenomenon of almost daily occurrence. A line drawn from point to point as indicated above coincides almost exactly with the northern limit of trees. Extended observation has shown that the brilliancy and frequency of the Aurora in North latitudes generally varies roughly with the number and size of the spots on the sun, or the intensity of its faculæ. That is to say, that its period of greatest brilliancy conicides with the maximum sun-spot period and comes about every eleven years. The Auroræ of 1859 and 1871 and 1872 were very remarkable. At the same time the electrical disturbances in the telegraph cables were very extraordinary.

2. What is the height of the Aurora above the Earth? The evidence here is most conflicting and varies between six miles (Franklin), and an extreme limit of 1,006 miles (Tompson). Probably the majority of Auroral displays take place at about 70 or 100 miles.

3. As to the regularity observed in its forms. The arc is the more constant of these. As a rule the higher the arc the wider apart are its extremities, the narrower it is, the more intense the light. Next are the Auroral bands. These are generally nearer the zenith than the arc, and consist of streamers of luminous matter, or of clouds with a peculiar phosphorescent glow, and often showing all the colours of the rainbow. Then we have streamers or bands of light darting vertically upwards, and then many parallel to the horizon. But the grandest phase of the Aurora is when the streamers play from all parts of the heavens towards the magnetic zenith, forming a huge dome or cupola of flame.

Lastly, as to the cause of the glow of the Aurora and of its magnificent colouring, white, green, orange, and red. Of these

the white and the red are by far the most common. The reddish tints are usually nearest the horizon. Comparing the colours of the Aurora with those of vacuum tubes, illuminated by an electric current, and containing different gases extremely attenuated or minute particles of metals, we find many points of agreement both in the form which is shown by the luminous clouds and in the colours produced. The spectroscope also has been applied in both cases. But while the spectra of the Aurora and those of vacuum tubes show that the phenomena of both often yield very similar results, there are many discrepancies and many problems yet which remain to be solved. Mr. Lockyer has experimented with meteorites, and concludes the Aurora is due to the electric discharge through meteoric dust in the higher regions of the atmosphere. There seems to be a connection between Auroræ and thunder storms.

Prof. Christison affirms that the first great Aurora after the commencement of autumn, and following a period of fine weather, is usually a sign of a great storm of wind and rain on the second day; and Mr. Prince remarks that displays of Aurora are almost invariably followed by very stormy weather after an interval of from ten to fourteen days. That the appearance of an Aurora is generally followed by considerable disturbance of the magnetic needle all are agreed. No scientific theory yet advanced as to the cause of the Aurora is entirely satisfactory. The one, however, which is most generally received is that the Aurora is caused by the passage of an electric current from the Equator towards the Poles, and in the resulting restoration of equilibrium between the positive electricity of the atmosphere and the negative electricity of the earth, acted upon, to a certain degree, by terrestrial magnetism. If this restoration of equilibrium take place near the earth, the result is the lightning flash, but if in the higher regions of the atmosphere, where the rarefaction is great, we shall no longer have the intense discharge of the lightning flash, but one more resembling an Aurora.

The lecture was illustrated by a series of large vacuum-tubes, the electric discharge through which reproduced many of the beautiful phenomena of an Aurora.

WEDNESDAY, JUNE 10TH.

Annual General Meeting.

REPORT OF THE COUNCIL

FOR THE YEAR ENDING JUNE 10TH, 1891.

During the past year an effort has been made to give to the scientific work of the Society a more definite and systematic form. A circular was issued to Members on March 3rd last, asking for their co-operation in a scheme which the Council had sanctioned for the formation of Sectional Committees who were to take charge of certain branches of Science. It may, perhaps, not be out of place to quote here a passage from the circular explanatory of its aims and objects.

"The object which the Council more particularly has in view is the investigation of the Archæology and Natural History of the County of Sussex. For this purpose each Section will endeavour to associate with it in its work all those, whether Members of the Society or not, who take an interest in that branch of Science, and who will undertake, as far as they conveniently can, the careful observation and recording of those facts which may be of service to the student and investigator."

Six Sections have been formed, and the following gentlemen have kindly offered to assist any Member who may be pursuing studies connected with his particular department, and to report to the Council any facts of interest which may come to his knowledge, viz. :—

Archæology, Mr. de Paris; Botany, Mr. Lomax; Entomology, Mr. A. Griffith; Geology, Mr. Pankhurst; Meteorology, Dr. Newsholme; Microscopy, Mr. Caush; Zoology, Mr. Borrer.

Mr. D. E. Caush, who has for the last five years kindly acted as the Society's Hon. Librarian, and under whose auspices the

present Catalogue was issued, has felt obliged to resign the post which he has so ably filled. Your Council, while regretting the loss of Mr. Caush, congratulates the Members on having obtained the services of Mr. Henry Davey, Jun., to fill the post which Mr. Caush has vacated.

The Annual Excursion of the Society took place on July 8th last, to Arundel, Amberley, and Bognor, and was attended by about 20 Members.

Since the last Annual Meeting the Society has lost four Members by death and seven by resignation. The decease of Mr. Henry Pratt, who read several valuable papers on astronomical subjects before the Society, is much to be regretted by all lovers of the noble science to which he was so devoted.

This loss of eleven Members has been exactly compensated by the election of an equal number.

The Papers read before the Society have been as follows:—

Oct. 8th, 1890.	Inaugural Address by the President (MR. G. DE PARIS). Subject: "The Present State and Future Prospects of the Society."
Nov. 12th, "	"The Antiquity of Man": MR. SAMUEL LAING, F.G.S., &c.
Dec. 10th, "	"The Development of the Flower": MR. E. F. SALMON.
Jan. 13th, 1891.	Evening for Specimens.
Feb. 11th, "	"Wild and Domesticated Animals Photographed and Described": MR. W. GAMBIER BOLTON, F.Z.S.
Mar. 11th, "	"Observations and Experiments on the markings and colouring of Lepidoptera as affected by Temperature": MR. F. MERRIFIELD.
April 15th, "	"The Evolution of the Solar System": MR. E. J. PETITFOURT, B.A.
May 13th, "	"The Aurora Borealis and allied Phenomena": MR. W. H. REAN, M.R.C.S.
June 10th, "	ANNUAL GENERAL MEETING: reading of Reports, &c. Ordinary Meeting at 8.30 for Exhibition of Specimens and of Microscopic Sections.

The thanks of the Society are due and are hereby given to those gentlemen who have read Papers before the Society.

The Field Excursions have been as follows:—

1890.	July 5th.	Lewes, Kingston, and Iford.
"	Aug. 9th.	Goring and Clapham.
"	Sept. 6th.	The Dyke and Beeding.

1891. April 18th. Lewes, Kingston, Swanborough Grange, and Iford.
" May 16th. Balcombe.
" June 6th. Henfield.

ANNUAL EXCURSION, Tuesday, July 8th, 1890, to Arundel, Amberley (Rev. G. A. Clarkson), Bury, Bignor, &c.

LIBRARIAN'S REPORT.

During the past year there has been but little alteration in the number of books sent out, but your Committee are anticipating an increase of readers during the coming year, as they have made many valuable additions to the Library during the past few months.

Your Committee are also desirous of tendering the best thanks of the Society to those who have during the year presented books to the Society.

D. E. CAUSH,
Librarian

Brighton and Sussex Natural History and Philosophical Society.

TREASURER'S ACCOUNT FOR THE YEAR ENDING 10TH JUNE, 1891.

Dr.

	£	s.	d.
By Balance in the hands of Treasurer, 11th June, 1890 ...	132	6	4
" Annual Subscriptions and Arrears to 1st October, 1890 ...	48	0	0
" Annual Subscriptions to 1st October, 1891 ...	60	10	0
" Entrance Fees ...	5	10	0
" Dividends on £100 2¾ per cent. Stock to April 5th, 1891 ...	2	1	3
" Amount received from Mrs. H. Woollams, for Book presented to Society by her ...	1	12	0
	£249	19	7

Balance in hands of Treasurer, 10th June, 1891 ... £52 14 11

NOTE.—*A sum of £100 is invested in £2 15s. per cent. Consolidated Stock in the names of the Treasurer and Honorary Secretaries, as Trustees for the Society.*

Cr.

	£	s.	d.
To Cash invested in the Purchase of £100 2¾ per cent. Consolidated Stock ...	96	2	6
" Books and Periodicals ...	46	15	6
" Printing Annual Report and Abstract of Proceedings ...	10	12	6
" Printing and Stationery ...	7	3	10
" Postages, &c. ...	7	13	3
" Reading Desk and Book Rest ...	2	5	0
" Subscriptions to Societies ...	2	7	4
" Subscription to "Pocock Collection Fund" ...	2	2	0
" Assistant Secretary's Salary ...	2	2	0
" Commission to Collectors for Subscriptions ...	5	5	0
" Gratuities to Assistants at Museum ...	2	10	0
" Expense of Annual Excursion ...	4	9	8
" Hire of Rooms and other Incidental Expenses of Meetings...	5	3	9
" Cost of Tea and Coffee at Meetings ...	1	2	10
" Fire Insurance ...	0	12	0
" Cheque Book and Cost of Power of Attorney...	0	7	6
" Balance in hands of Treasurer, 10th June, 1891	52	14	11
	£249	19	7

Examined with Books and Vouchers September 5th, 1891.

F. G. CLARK, } *Honorary*
J. E. HASELWOOD, } *Auditors.*

After the Reports had been read it was moved by Mr. E. J. Petitfourt, seconded by Mr. B. Lomax, and resolved—

"That the Reports now brought in be received, adopted, entered on the minutes, and printed for circulation as usual."

It was moved by Mr. D. E. Caush, seconded by Mr. J. E. Haselwood, and resolved—

"That the Treasurer's account be submitted to the Auditors, examined by the Council, and printed with the Report."

It was moved by Dr. Walter Harrison, seconded by Mr. C. F. Dennet, and resolved—

"That the following gentlemen be Officers of the Society for the ensuing year :—*President:* Mr. W. H. Rean, M.R.C.S. ; *Ordinary Members of Council:* Mr. H. Langton, M.R.C.S., Mr. J. Walter, Dr. A. Newsholme, M.R.C.S., Mr. E. J. Petitfourt, B.A., Mr. D. E. Caush, and Mr. C. A. Wells ; *Honorary Treasurer:* Dr. McKellar, Woodleigh, Preston ; *Honorary Librarian:* Mr. Henry Davey, Junr. ; *Honorary Curator:* Mr. Benjamin Lomax, F.L.S. ; *Honorary Secretaries:* Mr. Edward Alloway Pankhurst, 12, Clifton Road, and Mr. Jno. Colbatch Clark, 64, Middle Street."

Dr. W. Harrison moved, Mr. Henry Davey, Junr., seconded, and it was resolved—

"That the sincere thanks of the Society be given to the Vice-Presidents, Council, Hon. Librarian, Hon. Curator, and Hon. Secretaries for their services during the past year."

Mr. J. E. Haselwood moved, Mr. W. H. Rean seconded, and it was resolved—

"That the best thanks of the Society be given to Mr. George De Paris, now retiring from the office of President, for his assiduous attention to the interests of the Society during the past two years.

The meeting was then resolved into an Ordinary Meeting.

METEOROLOGICAL SECTION.

THE METEOROLOGY OF SUSSEX.

There is but little need for preface to the following tabular statements. Their value lies in the accuracy of the observations made, an accuracy which every care is taken to maintain, and which is vouched for by their incorporation in the Reports of the Royal Meteorological Society and in the Registrar-General's weekly and quarterly Reports.

Table I. embodies the chief meteorological data (except sunshine) for Brighton during the year 1890-91. Under each month's returns are placed the comparative figures embodying the results for the fourteen years 1877-90, thus enabling one to see at a glance to what extent the weather of last year deviated from the average of fourteen years.

In Table II. the number of hours of bright sunshine and the number of sunless days for Brighton, Eastbourne, and Hastings are given. The instrument used in each case is the Campbell-Stokes Sunshine-Recorder.

A. NEWSHOLME, M.D.

TABLE I.

Month.		Temperature of Air during Month. Highest.	Lowest.	Mean of All Highest	Mean of All Lowest.	Mean Temp. of Air.	Mean degree of Humidity, Saturatn.=100	Wind. Number of Days of N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.	Rainfall. No. of Days on which rain fell	Amount collect'd in Inches.
July,	1890 ...	74·5	47·4	66·5	54·0	60·2	78.	3	0	0	1	0	12	3	7	5	12	2·50.
"	1877-90 ...	...	...	67·3	55·0	60·5	73.	1·6	2·9	0·9	1·8	1·8	13·2	4·8	3·6	0·4	13	2·44.
August,	1890 ...	73·8	43·5	67·4	54·8	61·1	74.	2	3	0	2	0	13	3	3	5	15	2·67.
"	1877-90 ...	...	...	67·3	55·6	61·2	75.	2·5	4·7	1·5	2·2	1·2	8·6	5·4	4·3	0·6	12	2·59.
September,	1890 ...	74·1	40·4	67·1	54·8	60·9	75.	1	3	1	6	2	8	2	3	4	8	0·83.
"	1877-90 ...	...	...	63·6	51·4	57·3	79.	3·7	6·2	1·2	2·0	1·6	6·6	2·0	5·0	0·7	12	2·62.
October,	1890 ...	66·0	32·6	58·5	44·6	51·5	67.	0	3	1	4	1	10	0	8	4	9	1·57.
"	1877-90 ...	...	...	57·0	45·2	51·0	78.	4·2	6·6	1·9	2·1	1·6	5·6	2·9	5·3	0·6	15	3·84.
November,	1890 ...	57·3	17·9	50·0	38·7	44·3	84.	1	5	0	0	1	8	1	12	2	20	3 32.
"	1877-90 ...	...	...	50·1	41·0	45·5	86.	3·0	5·3	1·1	1·3	2·3	7·9	3·6	5·0	0·5	16	3·61.
December,	1890 ...	43·8	17·6	36·8	28·6	32·7	87.	3	23	1	2	0	0	0	1	1	3	0·47.
"	1877-90 ...	...	...	45·4	36·5	40·0	83.	3·9	6·3	0·9	1·7	1·8	7·2	3·4	5·6	0·2	14	2·47.
January,	1891 ...	52·7	20·2	40·5	31·5	36·0	93.	1	8	0	2	1	8	2	9	0	12	2·62.
"	1877-90 ...	...	...	43.7	34·8	39·3	86.	3·3	6·5	1·9	2·3	2·6	6·6	2·6	4·9	0·2	15	2·83.
February,	1891 ...	55·3	27·3	47·4	34·0	40·7	91.	0	12	1	0	0	3	2	10	0	0	0
"	1877-90 ...	...	...	45·1	37·7	40·9	81.	3·0	4·7	1·6	2·4	2·2	6·2	3·6	3·8	0·4	14	2·28.
March,	1891 ...	62·4	30·2	46·5	35·9	41·2	83.	1	9	0	1	1	9	2	8	0	16	2·92.
"	1877-90 ...	...	...	48·0	35·6	41·7	81.	3·2	7·2	2·2	2·3	1·2	6·2	2·9	5·3	0·5	12	1·82.
April,	1891 ...	64.3	29·5	51·3	38·8	45·0	80.	0	11	0	2	0	9	0	8	0	6	0·60.
"	1877-90 ...	...	...	52·7	40·5	46·8	81.	3·0	10·0	1·6	2·5	1·8	5·7	2·5	2.6	0·3	12	2·03.
May,	1891 ...	75·2	33·5	58·6	44·7	51·6	75.	1	10	0	3	1	9	0	7	0	13	2·56.
"	1877-90 ...	...	...	59·3	46·0	52·4	73.	2·7	8·7	1·4	3·2	2·6	8·1	1·6	2·4	0·3	11	1·93.
June,	1891 ..	74·8	40·2	66·6	52·5	59·5	88.	1	10	1	4	0	11	0	3	0	12	1·88.
"	1877-90 ...	...	...	65·6	52·5	58·8	72.	2·4	6·2	1·4	2·2	1·8	9·6	2·6	3·6	0·2	11	1·90.
Entire Year ...	...	75·2	17·6	54·8	42·7	48·7	81.	14	97.	5	27.	7	100	15	79	21	126	21·94.

TABLE II.

Year.	Month.	Brighton.		Eastbourne.		Hastings.	
		No. of Hours of Bright Sunshine	No. of Sunless Days.	No. of Hours of Bright Sunshine	No. of Sunless Days.	No. of Hours of Bright Sunshine	No. of Sunless Days.
1890.	July	182·9	0	185·6	2	192·8	1
	August... ...	209·2	0	200·2	0	193·9	0
	September ...	170·2	0	207·2	1	199·4	1
	October ...	124·1	5	125·3	8	134·3	7
	November ...	68·0	10	66·9	9	71·3	9
	December ...	35·3	21	38·0	19	48·6	18
1891.	January ...	73·5	12	81·7	8	87·3	9
	February ...	121·1	4	120·7	4	134·8	5
	March	107·8	4	108·1	7	105·4	7
	April	148·3	4	138·5	4	134·9	4
	May	235·7	2	216·1	4	215·3	4
	June	229·1	0	215·1	3	223·8	1
		1705·8	62	1703·4	69	1741·8	66

The number of hours of bright sunshine registered at the Royal Observatory, Greenwich, during the same period was 1220·7 hours.

ARTHUR NEWSHOLME, M.D.

BOTANICAL SECTION.

Mr. Thomas Hilton has kindly drawn up the following list of plants, with localities, found by him in the neighbourhood of Brighton. A few not collected by himself have added to them the name of the finder. Those marked by an asterisk are not in Arnold's "Flora of Sussex."

B. LOMAX, F.L.S.

Name of Flower.	*Locality.*
Allium ursinum.	Woolstonbury Hill.
Alyssum maritimum.	Southwick.
Anagallis cœrulea.	Kingston.
Asparagus officinalis.	Southwick.
Bidens cernua.	Near Nutley.
B. tripartita.	Near Isfield.
* Brassica Cheiranthus	Southwick.
Campanula rapunculoides.	Rifle Range, Brighton.
* Camelina fœtida.	Cliff, Southwick.
Cardamine amara.	Between Barcombe and Isfield.
Carduus nutanti-crispus.	Southwick.
Centaurea Jacea.	Near Hurst.
C. solstitialis.	Kingston.
Cephalanthera ensifolia.	Stanmer Park.
Cerastium arvense.	Racecourse.
Chrysosplenium oppostifolium.	Clayton.
Chrysanthemum segetum.	Near Racehill.
Cichorium Intybus.	Kingston.
Cnicus pratensis.	Hayward's Heath.
Cotyledon Umbilicus.	Southwick Green.
* Corydalis solida, I.	Ringmer.
Crambe maritima.	Kingston Beach.
Erigeron acris.	Downs, above Woodendean.
Erodium cicutarium.	Between Brighton & Newhaven.
Erythrea (capitata). b. sphæro-cephala.	Downs, between Portslade and the Dyke.
Erysimum cheiranthoides, I.	Near Rottingdean.
Euphorbia Cyparissias.	Henfield.
Galeopsis versicolor.	Racehill, Brighton.
Galium tricorne.	Clayton.
Gentiana campestris.	Between Falmer and New-market Hill.
Geranium phœum.	Wiston Park.
G. pyrenaicum.	Patcham, Henfield.
G. lucidum.	Uckfield.
* Gnaphalium uliginosum.	Falmer.
Habenaria viridis.	Hollingbury Camp.
H. bifolia.	Ditchling Common.
H. chlorantha.	Clayton.

Name of Flower.	*Locality.*
Helleborus fœtidus.	Above Ditchling (H. Hemmings)
Helosciadum inundatum.	Chailey Common.
Hyoscamus niger.	Cuckmere Haven.
Hottonia palustris.	Beeding Brooks.
Jasione montana.	Near Wiston.
Lemna polyrhiza.	Malling Brooks.
Lepidium ruderale.	Southwick.
L. Draba.	Rottingdean.
Linum angustifolium.	Near Rottingdean.
Linaria minor.	Near Brighton.
Lotus tenuis.	Near Newmarket Hill.
Lycopsis arvensis.	Near Henfield.
Malva borealis.	Southwick.
Melilotus abla.	Between Brighton and Kingston.
* Medicago falcata.	Kingston.
Mœnchia erecta.	Hassocks.
Montia fontana.	Chailey Common.
Myosotis collina.	Aldrington.
Nepeta Cataria.	Hangleton.
Orchis ustulata.	Mount Caburn.
Papaver Lecoqii.	Saddlescomb Road.
P. hybridum.	Common about Brighton.
Pedicularis palustris.	Near Iford.
Petasites vulgaris.	Brooks, near Iford.
Potentilla procumbens.	Near Sheffield Park.
Poterium muricatum.	Between Rottingdean and Falmer.
Ranunculus tripartitus.	Ditchling Common.
R. tricophyllus.	Albourn.
R. parviflorus.	Woolstonbury Hill.
Raphanus maritimus.	Southwick.
Rumex scutatus.	Fulking (Miss M. Robinson).
Sagina nodosa.	Littlehampton.
Sedum Telephium. Var. fabaria.	Henfield.
Senecio sylvaticus.	Downs, north and east of Falmer.
Senebiera didyma.	Southwick.
Serratula tinctoria.	Downs, north of Shoreham.
Silene, anglica, I.	Southwick.
S. Conica.	Kingston.
Silybum Marianum.	Cliffs, Black Rock.
Sisymbrium Sophia.	Southwick.
Spiranthes autumnalis.	Ladies' Mile.
Tanacetum vulgaré.	Near Isfield.
Thesium humifusum.	Between Rottingdean and New haven.
Thlaspi arvense.	Rottingdean.
Ulex Gallii.	Chailey Common.
Veronica Cristi-galli.	Henfield.
Viola lactea.	Piltdown.
Zostera marina. Var. angustifolia.	Basin, Southwick.

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TOGETHER WITH THE

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SESSION 1891-1892.

WEDNESDAY, OCTOBER 14th, 1891.

INAUGURAL ADDRESS

BY

MR. W. H. REAN, M.R.C.S.

(PRESIDENT OF THE SOCIETY), ON

THE MICROSCOPE IN SCIENTIFIC INVESTIGATION.

The subject to which I desire to direct your attention for a very brief space this evening is that of Microscopy, and I have chosen this particular branch of scientific research for two reasons, which reasons, with your permission, I will lay before you.

In the first place it has been to me for some years a continual source of regret to find that the study of the microscope—at least in the public utterances of this Society—has been seriously on the decline. Practical papers on microscope work have been conspicuous by their absence. The attendance at our microscopical evenings have dwindled both with regard to the selections of microscopes and objects on view, and also as to the members who have made it their duty to be present, until the audiences became as time passed on nearly as microscopical as the objects themselves; and your Council, seeing the lack of interest in the work wisely decided, for the time being at least, to do away with these evenings altogether. That such an eventuality should have occurred is, I consider, a grave reproach on such a Society as ours. Surely we have members enough among us who delight in microscopical research, and who possess instruments to raise microscopy once more to the place it commands in the study of natural history. And it is with the full belief that a little

stimulation may give the much-needed impetus to the workers and influence others to embark in the study of this most fascinating science that I have put these few remarks together.

Mark you well, I am not suggesting that microscopy is in abeyance, and that those members who have been workers in this field have gone back from their first love. Nothing of the kind. It is lack of appreciation that makes them hide their light under a bushel, and if the generality of our friends could only be made to take an intelligent interest in the subject I feel sure that these veterans we have among us would be only too delighted to come forward with their specimens to enlighten, to elevate, and to amuse.

In the second place microscopy is one of the few scientific studies in which men and women can compete with an equal chance of success, and therefore in a mixed Society such as ours it especially commends itself to our careful consideration.

Microscopic investigations can be moreover carried out at home, and in the most cleanly manner. A microscope is no discredit to the sitting or drawing-room, and the accessory apparatus is rather ornamental than otherwise. There is no season of the year or time of day when the work need be laid by. The summer holiday by the ocean's sunny ripple, or in the sweet country lanes; a few hours spent by the edge of some quiet pool, or a few dips from the water of some roadside ditch, will supply occupation and enjoyment for many a winter evening; and, finally, is there not the stimulus of discovery? The field covered by the microscope is so vast that there are but few who will carefully and intelligently take up a particular branch of this study but may certainly glean some fresh facts and add lustre to our science, and earn distinction for themselves.

It is not my intention to enter into a long description of the microscope, but we may perhaps profitably spend a few moments in considering the evolution of an instrument which, from a mere plaything, has become one of the most important aids to modern discovery, and marked an epoch in scientific history.

It is probable that the microscope, if we may designate a simple lens by such a name, was of very ancient origin, but we must form our conclusions upon this point rather from inference than from direct evidence. We know that spectacles were used in the 13th century, and probably consisted of convex, or magnifying, as well as concave glasses; also that at a meeting of the British Association in 1852 Sir David Brewster exhibited a lens which had been discovered among the ruins of Nineveh. Cicero

speaks of an Iliad of Homer written upon parchment which was contained in a nutshell, and must have been written by the aid of a magnifying glass; and Seneca refers to writings which appear "larger and clearer when viewed through a globule of glass filled with water: we may therefore, I think, fairly conclude that lenses, as such, were of a very early date.

But we must bridge over some centuries and come to the year 1585 before we can ascertain that a series of lenses were in various ways united together in one instrument, thus forming the germ of the compound achromatic microscope. About this period Jensen and Drebull, working quite independently, produced microscopes which, crude as they were, must be pronounced to be of a compound type; and in the year 1668 the account of a microscope manufactured by an optician named Divini, was read before the Royal Society. In 1738, Lieberkuhn's invention of the solar microscope was communicated to the public and produced a startling sensation, and enormously increased the number of workers in this field of scientific investigation. In the year 1818 experiments were carried out with the endeavour to render the combination of lenses achromatic, although at that time we read "that opticians regarded as impossible that this end could be attained;" but in 1829 Mr. Lister succeeded in rendering his objectives almost achromatic, by joining together a plano-concave and a convex lens by means of Canada balsam.

Since this date the progress of the microscope has been rapid. Year by year fresh improvements have been noted, both in perfection of lens, definition, and in mechanical arrangement, until now, with the introduction of the Jena glass for use in objectives, it almost appears as if the limit of human inventiveness has been compassed. But still so insatiable is the microscopist for some fresh advance in his beloved science, that, like Oliver Twist in Dickens' famous novel, we are constantly asking for more.

But now let us consider in what manner the microscope has been of such enormous importance in the progress and development of some of the sciences. Let us in the first place take "the science and art of medicine and surgery," as diplomas have it, together with their subsidiary adjuncts of physiology, biology, and pathology, which from vague imaginings, drifting hither and thither without any solid basis or foundation, have grown into well-defined sciences dealing with hard and solid facts under the fostering care of the parent medicine. It is true that in early days, when the compound microscope first came into existence, medical men looked askance at the costly toy as they

chose to term it. But facts were soon too strong, and prejudice was compelled to hide its diminished head. And then came the optical triumph. Many theories were tried in the furnace, as exemplified by the microscope and arose, phœnix-like from their ashes, golden facts, worthy to be set as jewels in the scientific diadem ; while others under the same process found a dishonoured grave beneath the ruins they had caused. To the physiologist and the biologist a new world seemed to have been opened up. They viewed with delight the treble coats of the arteries, and the circulation of the blood ; the delicate layers of the eye-ball and the tactile corpuscles of the fingers ; the ciliated epithelium of the nose, and the villi distributed over the intestine. Their theories became facts, and the two sciences advanced side by side with giant bounds, and so they have continued to progress to the present day.

The penetrating eye of the microscope has pierced deep beneath the surface, and week by week, nay almost day by day, fresh facts, fresh discoveries are being piled one upon the other with almost bewildering confusion.

In pathology, as dealing with diseased rather than healthy structures, the microscope still holds universal sway ; malignant tumours can be distinguished from those of benign origin with almost absolute certainty, and many maladies of obscure origin are now by their microscopical results made clear. And many a husband has been made supremely happy, many a mother has poured out her heartfelt gratitude to the Almighty when the physician, aided by the microscope as by the touch of a magician's wand, has been able to pronounce that the beloved wife suffers from no incurable disease, and that the mother's darling may long be spared to bring joy and sunshine to the household. In medicine the microscope has produced a revolution. The obscure has been made plain, the crooked straight. Many a disease which for generations had puzzled the physician and been an opprobium to science is now clearly under his eye, and he can, by a careful examination of the smallest particle of tissue, or the most minute drop of secretion, gauge the condition of the patient, watch the progress of the disease, and prognosticate the result.

It is to the microscope we owe the discovery of the various microbes which are now supposed by many to be the main cause of the majority of the ills that flesh is heir to.

I would not for a moment, however, have you consider that I give my adherence to the theory that many of our fatal diseases are produced by these infinitely small bacilli ; on the contrary, my

private opinion sets in quite another direction. All I assert is, that the microscope has discovered these parasites, and it remains for science to give the correct interpretation to their existence.

To the medico-jurist the microscope has proved invaluable. It has brought the criminal to justice by identifying a few grains of sand upon his boots, and, with all honour let it be said, it has conclusively proved the innocence or guilt of the man accused of the crime of Cain.

The closest companion of the analyst is the microscope. By its aid he detects the smallest particle of adulteration in our food and in our drugs, and woe betide the grocer who endeavours to palm off the spurious, though clever, imitation of "our finest Mocha coffee at 1s. 4d. per pound," or who induces us to purchase the sloe-leaf as "our full-flavoured congo, at 2s. 6d."

In our various dress materials and domestic fabrics the microscope enables us to detect the spurious from the real. We find without difficulty that our Lyons silk, a speciality at 3s. 7d. the yard, is composed of certain substances to which the silk-worm would claim no relationship; and that the Angora, or even our common sheep, would turn up its nose at many tailors' materials which are flaunted before our faces as "all wool, 13s. 6d. to measure."

Turning now to geology, we find in the microscope the touchstone to which all its theories may be brought, for geology up to a few short years ago was very purely of a theoretical character. But many of those theories are now, thanks to the microscope, proven and well-established facts. Who on picking up a piece of chalk on our downs would conclude that those breezy heights had in some remote generations been burrowed deep beneath the ocean; that our great limestone formations are but the remains of animal life in long past ages; that our gigantic coal-fields, to which the wealth of our country is so largely due, were once on the surface of the earth examples of the most luxurious tropical vegetation? We plunge our sounding lead far down to the ocean's depths, and on its tallowed base bring to the surface a small particle of ooze, and the microscope tells us at a glance that what is now taking place at enormous distances beneath the sea is practically a continuation of the same geological change which formed our chalk hills and gave existence to our limestone ranges. In the infinitely minute diatom, in the delicately-marked foraminifera, and the exquisite polycystina we leave theories far behind and in their place have proofs as strong as those of holy writ.

The science of botany again owes much of its development to the light thrown upon the history of plant life by the aid of the microscope. Indeed, many thousands of minute vegetations would never have been studied at all without its valuable assistance.

The improvements in the construction of the microscope may be said without exaggeration to have opened up a new botany altogether. The minute movements of the diatom, the simple though perfect, formation of the desmid, the birth, growth and decay of moulds and fungi and other infinitesimal vegetable forms would never have been brought to light if they had not been placed under the penetrating eye of the objective or upon the stage of the dissecting microscope.

Vegetable physiology has developed into a science almost entirely since the date when the simple gave place to the compound microscope and enabled us to distinguish the cells and their contents, the modifications undergone befitting them to carry out the great aim of their existence, and from mere masses of colourless protoplasm to build up those magnificent structures which not only bathe the surface of our earth and gladden our eyes, but give to us some of our most valuable commercial products.

Where, may I ask, would the zoologist and the entomologist be without the aid of the microscope? How would he distinguish between the multitude of minute organisms, many of them practically invisible to the naked eye. Should we ever, without the microscope, have possessed such magnificent works as "Pritchard on Infusoria," or "Fownes on the Blowfly?" Or from what source would the information have been derived that would enable us with unerring certainty to detect the obsequious but destructive parasite and countermine his attempts upon our lives and property?

Chemistry and physics too, those sciences of mouth-distorting terms, would feel as if there was something lacking in their armament and a difficulty in arriving at precise details, if there were not the micro-polariscope to assist in the systematic arrangement of crystallizations, or the depositions of solids from their solutions. And the micro spectroscope enables us as clearly to define the contents of a single drop of liquid as does the spectroscope when applied to the elucidation of the problem as to the manufacture of worlds.

In illustration of the subjects treated in his paper, Mr. Rean exhibited at its conclusion a number of microscopic slides of great interest.

WEDNESDAY, NOVEMBER 11th, 1891.

THE SCIENTIFIC ASPECT OF FOLK-LORE.

BY

MR. HENRY DAVEY, JUN.

By folk-lore I understand customs and beliefs of any kinds; it will be important to remember this definition, for another definition might bring quite other conclusions as a result of the reasoning. To future ages, if science should be still studied, our own customs and beliefs will be also folk-lore. By science I understand not the simple accumulation of unrelated facts, but the use of facts which can be correlated, co-ordinated, and built into a coherent system; of facts which can be shown to have a connection; the pointing out this connection, and the construction of the system, being science.

Now, what first strikes a student of folk-lore is the identity of the folk-legends of different countries. To take a familar instance, the story of William Tell's shooting the apple from off his son's head. An exactly similar story occurs in the legends of the Turkish nation, and also of the Samoan Islanders in the South Seas. Surely none of these nations can have had the slightest communication with the others, and the story must have been evolved entirely independently. I might give many other instances of the same similarity, the correspondences sometimes extending down to the minutest details.

The method now most in favour of explaining these singular coincidences, which are of very great number, is that of *comparative mythology*. It is admirably described by Mr. Andrew Lang in his work "Custom and Myth."

"The method is, when an apparently irrational and anomalous custom is found in any country, to look for a country where a similar practice is found, and where the practice is no longer irrational and anomalous, but in harmony with the manners and ideas of the people amongst whom it prevails. That Greeks should dance about in their mysteries with harmless serpents in their hands looks

quite unintelligible. When a wild tribe of Indians does the same thing, as a trial of courage, with real rattlesnakes, we understand the red man's motives, and may conjecture that similar motives once existed among the ancestors of the Greeks. Our method, then, is to compare the seemingly meaningless customs or manners of civilized races with the similar customs and manners which exist among the uncivilized and still retain their meaning. It is not necessary for comparison of this sort that the uncivilized and the civilized race should be of the same stock, nor need we prove that they were ever in contact with each other. Similar conditions of mind produce similar practices, apart from identity of race or borrowing of ideas and manners."

The examination of savage customs, or their survivals in the shape of quaint practices whose original meaning has long been forgotten, is therefore a distinct branch of present-day science. We expect a botanist, geologist, or zoologist, when travelling into remote countries, to register the customs he finds observed, and to give a full account of them when he publishes the results of his labours in his own special pursuit. The subject has also not been without a certain indirect influence upon literature, especially upon the study of obscurities in the great Greek classics; also it has a not unimportant place in the history of language, with which indeed it has by one branch of students been most intimately involved. This school of thought is advocated by Professor Max Müller; its method consists in finding a word something like the name of the object or person named in some folk-story, and explaining the story, or the custom which may be in question, as arising through a confusion of words in the popular intellect of a remote age. Here is an example which will make the method clear. We find in Greek mythology that the laurel (in Greek, Daphne), was sacred to Apollo; and a story was told of how Apollo had been enamoured of a girl named Daphne who fled from him, but was overtaken, and on calling for divine help was suddenly changed into a laurel. This story is expounded by Max Müller as follows. Phœbus Apollo, as the sun, follows the dawn, which in Sanscrit is called Dahana, or Ahanâ. The yet older Aryan word must have been nearly the same, and when a similar name was given to the laurel, a confusion arose between the dawn and the laurel, and in time it was supposed that it was the laurel which the sun-god pursued, and thence it was an easy transition to the idea that Daphne had been a girl before she became the tree sacred to Apollo. This philological method is really more than 2,000 years old, and was

actually adopted by some of the Greek writers, Plato and Euripides for instance, to explain away some of the more repulsive features of Greek legends, which shocked the thinking minds of Periclean Athens. That it in many cases is perfectly correct I do not doubt; but its advocates push it to an inordinate extreme, and it is peculiarly liable to be misused. Even its leading practitioners disagree among themselves to an extent quite exceptional. Thus the change from Dahana to Daphne has been violently attacked by several of Max Müller's compeers, as opposed to the natural phonetic decay of words.

The actual *verbal* inspiration of the Hebrew Scriptures is no longer considered a reasonable theory among educated men, and accordingly I trust I offend nobody by referring, as a very salient and familiar instance, to the many cases of the use of this method in the Old Testament. A miraculous appearance is described, or perhaps an ordinary event, then we read, "Therefore the name of that place was called So-and-so unto this day." I personally have perfect faith in the general historical accuracy of the Old Testament; and our modern antiquaries explain plenty of familiar names of places in exactly the same way, as, for instance, the two Sussex hamlets called Dane Hill, a singular parallel to the place which, as we read in the 18th chapter of the Book of Judges, was called Mehaneh-dan, that is, the camp of Dan.

These two methods are applied by the two principal schools of folk-lorists. There are, however, other methods, such as the one to which Euhemerus has given his name; he explained all myths as the distorted accounts of natural facts, and declared that the gods and demigods had been actual men, whose exploits had been magnified and misrepresented by traditions. All the methods, however, must be applied, as each one will be correct occasionally.

To leave this part of the subject, and examine the origin of folk-lore. With the veriest rudiments of civilization man begins to ask certain questions which, as far as we know, other animals have never thought of. He asks, why do men die, and what becomes of them when they are dead? Why do we see the sun for a time, and then lose it for a time? Why does the moon continually go through its unvarying cycle of changes? Why are certain plants useful and others noxious? Why does a hunter sometimes obtain prey, at other times find it escape him, at other times sees none, and at other times has the prey turn upon him and kill him? At that stage of civilization man has not come to look upon himself as something fundamentally different from the

beasts, as he learns to do at a later stage; and he imagines himself of kin to the animals he sees, just as, when the wheel has gone full circle, the latest developments of highest science lead to the same result. An amusing incident is related by Schoolcraft, concerning a chief of the degraded Digger Indians, who told a traveller that the first Indians were coyotes, and when one of them died, his body became full of little animals or spirits, who took various shapes, but gradually, on the purely evolutionary method, developed into men. "At first they walked on all fours, then they would begin to put forth an isolated human feature, one finger, one eye, like the Ascidian, our first parent in the view of modern science. Then they doubled their organs, got into the habit of sitting up, and wore away their tails, which they unaffectedly regret." A few old women of the tribe alone are so behindhand as to believe in the immortality of the soul; and thus we see that these lowest degraded savages are quite at one with the most advanced nineteenth-century ideas.

In this rudimentary stage, man not only personifies the beasts as of kin to himself, but also treats inanimate objects in the same manner, especially those heavenly bodies whose motion he can see. Every barbarian nation thinks and speaks of the sun and moon as persons with the passions of men, and very strong sexual instincts. It is not long, probably, before the idea of the fetish is matured. Then a savage begins what we call worship of the fetish; and here we must guard against confusion of ideas. Worship, to a savage, is a very different thing from what we call worship. A savage is not clear-headed enough to distinguish between facts and imaginations; the phenomena of dreams in particular are real events to the savage. Exactness of statement, exactness of number, are impossibilities to a savage, who has even a deficiency of vocabulary; and he could not tell you what his feelings exactly are with regard to the fetish he has made. We say that he worships it because we have no other word to express the act. It must be remembered that the observed motions of the sun, moon, and planets, and the course of the seasons, were really most inexplicable matters for many centuries. We cannot put ourselves in the position of men who have found no explanation for daily occurrences, although there are many puzzling phenomena still awaiting solution. Thus, many inexplicable noises are to be heard in primeval forests, which the natives declare to be the work of spirits; scientific observers do not believe that they are caused by spirits, but they can give no other explanation. Bates has described the mysterious sounds he has

heard in the Amazonian forests, and similar accounts come from Ceylon. Everything not immediately obvious becomes obvious enough if we admit invisible agency; and the savage finds that the wind, which is invisible, is an extremely powerful being, which makes it easy enough for him to fancy that there are other invisible beings which cause the results not obvious to him. These invisible beings he creates to himself in his own image, after his own likeness, as was noted by the Greek philosopher Xenophanes long before the time of Plato. The element of chance has not been sufficiently noticed in the study of the origin of beliefs and customs. That ill-success in an undertaking, as for instance in finding game, should have been considered due to the malevolence of a personal being, must have been a very early notion. Another point to which much attention has of late been directed, is the worship of stones. Whenever a savage race finds a large stone left by glacial action in a peculiar position, it bows down before the unknown forces that placed the stone thus, and everywhere we find large stones held in peculiar reverence.

Perhaps the most wonderful invention of man is that of fire. Man has been defined as a cooking animal; and the cooking of meat makes it so much more digestible that this one point has given man an enormous advantage over the beasts, by liberating a very large part of his energy from the mere process of sustaining life. Now savages all over the world have discovered how to produce fire in a few minutes by rubbing a sharpened stick in a hollow stick. Folk-lore is not silent as to its discovery, and everywhere we find that some national hero is supposed to have brought fire from heaven concealed in a stick. Savages who saw fire produced in the storm-cloud above, sometimes communicated to the earth, naturally thought it must have been brought thence; and the Greek name Prometheus is singularly reproduced in *pramantha*, the Sanscrit word for the fire-making instrument. This is an excellent example of the right use of the philological method.

The notion of magical power which speedily associates itself with the fetish often lingers through association down into more advanced periods of national culture. This was very strikingly the case in ancient Greece. Pausanias, as late as the second century of our era, found, as he made his tour through Greece, that the works of its great artists were duly valued, but that the rude inartistic stone images of much earlier times were more reverenced. The tales, often grotesque, sometimes revolting,

of the deeds done by heroes and gods still had an indefinable credence in the popular mind.

This nation, the most artistically cultivated ever known, could still celebrate disgusting or meaningless ceremonies. These facts, examined by the scientific method of comparative mythology, are explicable enough; and we know from them something of what the original condition of the Greeks must have been long before the dawn of historical records. Comparative mythology teaches us that each clan had in primitive times its own stone fetish or beast totem; and, as the nation gradually integrated, all the various deities were united by poetic fancy into a family, with a family history like that of the Greek princelings of the time. It is a great stumbling-block to the exponents of the philological method that they can find no etymology of the Greek names for the gods, excepting only two: Zeus, which is the same as Dyaus, meaning originally the sky; and Demeter, Mother Earth. Nothing whatever can be done with such names as Apollo, Athene, Artemis, Hera, Cronion, Dionusos, Hermes. In earliest times we find these mysterious names known and honoured.

When we leave the consideration of the Aryan nations and turn to the savages of our day, we find practices like those of the ancient Greeks still existing in Asia, Africa, America, Oceania, nay even more than enough in Europe. In dealing with the beliefs and customs of present-day savages, the philological method is helpless. But they throw complete light on the inexplicable customs which have lingered in more civilized nations. A dead soldier is followed to the grave by his led horse; a semi-civilized nation does that, and kills the horse into the bargain, that the deceased may have a fair start in the next world.

The entire subject of folk-lore suggests some instructive thoughts to the mind. How amazed the advanced thinkers of a century ago would have been at the discussion of savage rites and customs as a branch of science. The entire point of view has changed. Advanced thinkers are no longer oppositional and negative, as the eighteenth century thinkers were. Now-a-days we hold that everything has its place, that the beliefs and customs of past ages, however grotesque or repulsive, were exactly adapted to their own time. It is partly because we now hold that all things are connected and indispensable to each other, that we consequently regard all things whatever as amenable to the methods of science and as separate manifestations of that ever-working Power which our

minds cannot grasp but which appears to us as infinite in time, and working in infinite space, alike unwearied and unchanging. Man has found no decisive answer to his questions ever since he began to ask them. At one time man believed the moving sun, the moving and changing moon, the moving planets, were beings with appetites like his own; now we know that they move by obedience to the law of gravitation, and that some of the motions are optical effects only; but we do not know why the law of gravitation exists. We, with our mastery over some of the inexplicable forces of nature, yet have just as little ultimate absolute knowledge as the men who fancy themselves kin to beasts, or who venerate an erratic block.

At the conclusion of Mr. Davey's Paper, Mr. D. E. Caush gave a demonstration on "Mounting Microscopical Objects."

WEDNESDAY, DECEMBER, 9th, 1891.

A PIANO OF COLOURS,

BY

MR. L. LEULIETTE.

The analogy between light and sound has for long been a subject of interest to musicians as well as to physicists. They are both the result of wave motion. The waves of air which produce in our brain the sensation of music are indeed slow compared with that continuous ripple which on our retina gives us the sensation of colour. Nevertheless NUMBER is at the base of both phenomena. It is to the difference in the number of air-vibrations that variety of tones are due, and it is to a difference in the number of ether-vibrations that variations of colour are due. Moreover, there is a gamut of colours as there is an octave of sounds, or at any rate there is the natural scale, if it may so be termed, running from red through orange, yellow, green, blue, and indigo into violet. Now, music which gives pleasure to the ear results from certain combinations of notes.

These combinations, simultaneous or successive, are governed by certain laws. Some notes sounded together make a concord, others a discord; certain colours also placed together afford us pleasure others offend. There are harmonies of colour as well as of sound. Two adjacent notes and two adjacent tints in the gamut of colour are discordant, alternate notes and alternate colours are concordant. Seeing that these striking analogies exist, have we not here a source of pleasure and a method of expression almost untouched? Is it not possible that rapid combinations of colour may be formed so as to produce to the eye somewhat the same effect as music to the ear? Is it beyond the skill of our mechanicians to design an instrument whereby the performer shall be able to translate his thoughts into harmonies of colour as now he can into harmonies of sound? It seems that either by the aid of sunlight, or by the electric light passing through coloured media which may be capable of quick transposition, it would be possible to have a piano of colour, in which the notes should be light waves, not sound waves, and the operator touching the keys should be able to produce symphonies which should appeal to the eye rather than to the ear.

WEDNESDAY, JANUARY 13th, 1892.

MICRO-PHOTOGRAPHY

(With a Demonstration),

BY

MR. D. E. CAUSH.

Mr. Caush explained the apparatus generally employed for taking micro-photographs, and the methods he had himself followed with regard to plates, developing, &c. Several successful photographs were taken by way of illustration.

WEDNESDAY, FEBRUARY 10th, 1892.

REMINISCENCES OF OUR EXCURSIONS, ARCHÆOLOGICAL AND OTHERWISE

(*With Illustrations with the Electric Lantern*),

BY

MR. WALTER HARRISON, D.M.D.

Mr. Harrison exhibited a large series of admirable photographs which he had taken of the places in the neighbourhood more or less familiar to the members of the Society through the excursions, noting anything which called for special remark in the pictures of the ruins or churches which were thrown on the screen.

WEDNESDAY, MARCH 9th, 1892.

PROJECTIONS OF MICROSCOPICAL SECTIONS ON THE SCREEN BY THE ELECTRIC LANTERN,

WITH EXPLANATIONS BY

MR. D. E. CAUSH, MR. PETITFOURT, AND MR. LOMAX.

WEDNESDAY, MARCH 23rd, 1892.

ON RINGING AND FINISHING MICROSCOPIC SLIDES,

BY

MR. D. E. CAUSH.

WEDNESDAY, APRIL 13th, 1892.

SOME OF THE MORE REMARKABLE RESULTS OBTAINED BY THE USE OF PHOTOGRAPHY IN ASTRONOMICAL RESEARCH;

(With Illustrations by the Electric Lantern),

BY

MR. EDWARD ALLOWAY PANKHURST.

The rise of astronomical photography may be said to date from 1839, when Daguerre took a picture of the moon by the wonderful process of light printing which he discovered. The next year the great astronomer Arago, who foresaw in a measure the aid which the new process would bring to astronomy, presented to the Academy of Sciences a negative of the moon much superior to Daguerre's. Great difficulties however stood in the way of complete success. The old wet process demanded an exposure of twenty minutes even for the moon. Moreover, the mechanician had not yet perfected those clocks which regulate the movement of the telescope, and which, keeping time with such wonderful accuracy with the motion of the earth, enable astronomers to keep any sidereal object he may wish to observe or photograph undeviatingly in the centre of the field of his optic tube.

In 1851 the collodion process was discovered, and almost simultaneously the driving mechanism of the telescope was greatly improved. The result was that in 1853, Warren de la Rue, with his 13 in. reflector, obtained some remarkable results in lunar photography. Astronomers were not able to avail themselves of all the advantages which large refractors possess for photographing the heavenly bodies on account of the optical difficulties connected with the process. The focus of the actinic rays is not the same point as that of the visual rays. Dr. Rutherford, however, overcame this difficulty by grinding his lenses so as to meet the exigencies of the case, and in 1864 was rewarded for his trying work by obtaining photographs of the moon which still excite our admiration.

Good photographs of the sun were, however, taken much earlier, the conditions of the problem being simpler. Even as soon as 1845 Fizeau and Foucault got a fine Daguerreotype of it. Much of our recent knowledge of solar physics is a direct outcome of the application of photography to the solution of the great problems which present themselves more prominently during an eclipse. In 1863 Huggins had already photographed the spectra, but it was in 1868 that the spectroscopy of the eclipsed sun virtually began. It was in this year, too, that the first notable results were obtained by photography of the height and appearances of the protuberances and of the extent of the corona.

The aspect of the planets also has not been overlooked, but owing to the faint light which they emit, their great distance, and the slight variation in tint of the markings on their surfaces, the results are not so striking or valuable as those obtained from the sun and moon.

In 1881 the perfection of the delicate and sensitive gelatino-bromide plate, placed a new instrument for research in the hands of the astronomer. The waves of light, too faint to affect the retina of the eye even when concentrated by a large telescope, accumulate their effect in a long exposure of a gelatino-bromide or chloride film to their rays. The continued ripple of vibrations are competent to bring about those molicular changes in the unstable equilibrium of the silver salts, and impressions are thus registered of appearances beyond the utmost limit of human vision, even when aided by the largest telescopes. The magnificent photograph of the nebula in Orion obtained by Draper in 1881, with an exposure of one hour, and the still later achievements of Common and Roberts with exposures of three and four hours, reckon among the most astonishing and suggestive results achieved in the domain of celestial photography.

But photography was destined to throw a light in a manner little suspected at first on the great problem of the motions of the fixed stars. Doppler, basing his reasoning on the analogy between light and sound, enunciated the theory in 1842 that the accession or retreat from our system of a star would reveal itself in a shifting of the lines of the spectrum, and that the variation from a normal would afford us the means of measuring the vast orbits which they traversed in these abysses of space beyond our tiny system. In 1868 Huggins confirmed by direct observation the truth of Doppler's speculation, and showed by comparison of the spectrum of the same star, taken at different intervals, that

at one period certain lines were shifted towards the violet end and at another time towards the red. He concluded, therefore, that the star was moving towards us in the first case and away from us in the second. By the application of this method, and by the perfection of the instruments used in measurements requiring such care and exactitude in which even a hair'sbreadth is a matter of moment, astronomers have been able not only to compute the orbits of suns which are visible to us, but even to infer the existence of the obscure companions of their course and to describe the invisible.

But the part which the *camera* has played in stellar photography is perhaps even more remarkable than the telescope has done. In 1882, Dr. Gill, of the Cape Observatory, essayed to obtain a photograph of the comet visible in that year by means of an ordinary portrait lens of 2 in. aperture. To his surprise he saw on developing the plate the impression of stars not visible even with a comparatively large telescope. The news of the discovery soon brought many enthusiastic workers into so promising a field of investigation. The excellent work of Pickering in America, of Pritchard in England, and the Brothers Henry in Paris, soon obtained notoriety. At Dr. Gill's suggestion a conference of astronomers was convened at Paris in 1887, and then it was decided, by the co-operation of astronomers in all countries, to commence a photographic chart of the heavens. Argelander's great map which gives the magnitude and position of all stars down to the ninth magnitude, which are to be found in the track of sky extending from the North Pole to about two degrees south of the Equator, contains 320,000 stars. Dr. Gill has very recently sent home, as the first instalment to his work on the photographic chart, a plate so small that it would be hidden by a shilling held at arms length, yet containing no less than 50,000 stars.

WEDNESDAY, MAY 11th, 1892.

AN EVENING FOR CONVERSATION, THE EXHIBITION OF SPECIMENS, &c.

Mr. Edward Crane, F.G.S. (Chairman of the Museum Committee) called particular attention to a species of two-toed sloth belonging to the Museum (*Cholœpus Hoffmanni*). Its hair is in life covered with a species of green alga. This extraordinary growth, of which no remains exist in the stuffed specimen, must be of great advantage to an arboreal creature like the sloth, which seeks its food among the green leaves and branches of trees; its colour affording it also protection from its enemies, sleeping as it does among the branches during the greater part of the day. The sloths are inoffensive, nocturnal animals. They possess great tenacity of life and survive severe injuries. Professor Kitchen Parker considered the evolution of protective characters as better seen in this group than in any other. The dry, shaggy character of the hair makes them inconspicuous among the trees of the forest, and it is enhanced by the greenish tint of this outer covering—which is not common in mammals. This is not due to the colour of the hair, but to the presence upon its rough surface of an alga, which grows upon the fluted surface of the hair. This strange growth is promoted by the dampness of the forests in the tropical regions which the creature frequents, for the genus occurs only in Brazil and Central America. The alga disappears when the animals are kept in captivity in this country.

Miss Agnes Crane exhibited a specimen of the long-tailed trogon from South America (*Trogon resplendens*), and remarked that it was the sacred Quetzal of the ancient Aztecs and now the national emblem of the State of Guatemala. The specimen exhibited was a male. The two enormous tail feathers being developed on the male bird only, the female being small and sober-coloured, and devoid of these extra adornments. The Quetzal's tail plumes were much valued by the ancient Mexicans, and large numbers of the birds were shot simply for the plumes, as they were used in the decoration of the Aztec idols or images of hero-gods, and their use was otherwise restricted to the chief priestly warriors or "supreme war-lords" of Mexico, who wore head-dresses formed

chiefly of the long-tail plumes of this species of insect-feeding forest-haunting birds. The traces of such a fringe of long-tailed Quetzal feathers are preserved on an ancient Mexican shield formed of the interlaced bamboo strips and decorated with featherwork. A *facsimile* of such a shield was also exhibited, one described and figured by Mrs. Zelia Nuttall in a memoir on Ancient Mexican shields, in a recent number of the *Archiv für Ethnologie*. This shield was rediscovered by her at the castle of Ambras, near Innspruck, in Tyrol, and once formed part of the famous "Ambras collection" of historical armour belonging to the Archduke Ferdinand of Tyrol, nephew of the Emperor Charles V. This collection is now removed to the Imperial Ethnographical Museum in Vienna, where the famous "feather head-dress of the time of Montezuma," also described by Mrs. Nuttall, is now preserved. There is documentary evidence that both feather head-dress and the shield in question were sent by Cortes from Mexico as presents to the Emperor Charles V. This shield is one of four others extant in the Museums of Mexico City, Stuttgart, London and Vienna. It is the only one having any claim to be considered as the shield of Montezuma, as it could only have been used by a personage of high rank in ancient Mexico. The use of the head-dress shields, and military accoutrements in general being regulated and restricted to different grades of the military ranks.

From the large numbers of various kinds of shields figured and described in native MSS. and the "Spanish Inventories," it is further evident that the Ancient Mexicans had independently developed, long anterior to the epoch of the Spanish Conquest, an heraldic system with emblems to blazon forth or proclaim their individual prowess in battle. Some of these emblems were the *images* of the labrets or lip ornaments and nose crescents of gold granted by their ruler as distinctions to these semi-barbaric warriors and actually worn by them. They were granted in recognition of gallant deeds of arms performed in religious inter-tribal wars, *capturing their foes alive* in order that they might be offered as living sacrifices to the gods of the Aztecs. These crescents quartered on the "field" of the shields recall the badge of augmentation on the coat armour of "The Pelhams" in commemoration of the ancestral share in the capture of King John of France at Poictiers. "A highly well-born" German family also quarters a negro's head to record their ancestors capture of a black Princess in the Crusades. The further discovery that the ancient Mexicans depicted symbols on their

shields with a phonetic value—the equivalent of the "armes parlantes" or canting arms of Europe, such as the three cocks of Cockayne, the Cranes of Cranstoun, three whelk shells of Shelley, and the spear in the Shakespeare coat—is one of the most interesting of Mrs. Nuttall's many important discoveries in Mexican Archæology, and Miss Crane felt glad to have the pleasure of bringing it before this Society.

Mr. Pankhurst exhibited a specimen of *Paris Quadrifolia* and *Lathræa Squamaria* found in the county; and Miss Nash some beautiful work in feathers, though she was unable to say from what part of the world it came.

WEDNESDAY, JUNE 8th, 1892.

At the close of the Annual General Meeting an Ordinary Meeting was held, at which a Paper, entitled

FACTS AND FICTIONS CONCERNING BARNACLES,

WAS READ BY

MR. E. J. PETITFOURT, B.A., F.C.P.

The myth with which the Barnacle (Lepas Anatifera) is associated consisted in the belief that the animal passed through two transformations—fruit to fish and fish to fowl; this opinion prevailed for 500 years and the following are the leading authors who have referred to it.

Giraldus Cambrensis (1147-1222), a great divine under Henry II. in his "*Typographia Hiberniæ*" describes barnacles as "birds produced from fir-timber, surrounded by shells to make them grow more freely; they have feathers and derive their food and growth either from the weed or the sea. They neither hatch nor lay eggs, now do they seem to have nests" Albertus Magnus (b. 1205) combated the popular belief but was unable to shake it.

Sir John Maundeville, contemporary of Chaucer, in his "*Voiage,*" dedicated to Edward III. (1356) tells us of a con-

versation he had in the "Lond of Cathay" with the natives and how he aroused their scepticism by describing the Bernakes as "trees that beren a fruit that becomen bryddes fleeyinge; and tho that fellen in the water lyven; and thei that fallen on the earth dyen anon." Æneas Sylvius (Pope Pius II. b. 1405) ridiculed the current error, with no more success than Albertus.

Baptista Porta, the Neapolitan Natural Philosopher and inventor of the "Camera Obscura," in his "*Natural Magic*" (1558), refers more cautiously to the reports of writers concerning the existence of the Barnacle not only in Scotland but even in the Thames near London. He also asserts that they which fall into the sea alone live and "grow to be ducks or such like birds;" and again "Some say they come of worms, some of the boughs of the trees which fall into the sea."

John Gerard, author of the "*Herbal*" is the most celebrated author on this subject, and his quaint picture of the Barnacle Tree is well known. He says that "the shell of the Barnacle is in shape like that of the muskle but sharper pointed and of a whitish colour, wherein is contained a thing in form like a lace of silk, finely woven, as it were, together, and of a white colour. . . . when the shell is perfectly formed, it gapeth open, and the first thing that appeareth is the aforesaid lace or string; next come the legs of the birds hanging out. As it groweth greater it openeth the shell by degrees till at length it is all come forth and hanging only by the bill. In a short space it cometh to full maturitie and falleth into the sea."

Michael Drayton's "*Polyolbion*" (1613) has a reference to "the anatomized fish and fowl from planchers sprung." Count Mayer wrote a treatise in 1629, "*De Volucri Aerborea,*" in defence of prevailing opinions, supporting his views by physical, metaphysical, and theological arguments.

Butler's "*Hudibras*" (1663) inveighs against those who "As naturally grow miscreants, as Barnacles turn Solan [Solent, *i.e.*, English Channel] Geese, in the Islands of the Orchades."

Sir Robert Moray in "*A Relation Concerning Barnacles,*" published in the "Philosophical Transactions" (1678), goes to greater lengths in his description of the "bird" within the shell. "The little bill like that of a goose, the eyes marked, the head, neck, breast, wings, tail and feet formed, the features everywhere perfectly shaped and blackish coloured, and the feet like those of other water-fowl, to the best of my remembrance."

It was about this time that Ray brought the weight of his authority against the myth. Nevertheless, the life-history of the Barnacle has only been worked out within the last 50 years. In 1830 J. Vaughan Thompson published the results of his searching observations on the subject, and, lastly, Darwin's "*Monograph on the Cirripedia*" (1851-53) settled all points of difficulty in the metamorphoses of the Barnacle beyond dispute.

The origin of the myth is due to confusion between two similar but unconnected words,—A. Barnacle, Fr. *Bernache* and *Bernacle,* both used indifferently for the crustacean and the bird. These are derived from the Low Latin *Pernacula,* diminutive of *Perna,* a shellfish (Pliny).—B. Barnacle goose, Low Latin *Bernaca* Fr. *Bernache.* The persistence of the myth is due (1) to the fact that the Barnacle goose breeds in North Europe and not in Britain; (2) to the fancied resemblances; (3) to the love of the marvellous, and to prejudice partly based on the authority of the learned.

The Barnacle passes through four stages—(1) the egg, (2) the *Nauplius* stage,—here the animal is microscopic, free swimming, with a broad shield on its back, three pairs of legs, one eye, a mouth and a forked tail, (3) the short *Cypris* stage,—the shield folded over, forming two valves, a pair of suctorial feelers, six pairs of strong swimming legs with forked ends, a pair of compound eyes and a functionless mouth, (4) the mouth resumes its function, the two feelers unite into a fleshy adherent peduncle, the three remaining valves are formed and the swimming legs become predatory tentacles. Thus is developed the Barnacle, a creature briefly summed up by Huxley as "a crustacean fixed by its head and kicking the food into its mouth with its legs."

WEDNESDAY, JUNE 8TH.

Annual General Meeting.

REPORT OF THE COUNCIL

FOR THE YEAR ENDING JUNE 8TH, 1892.

The Council congratulates the Society not only on the large access of new members to it in the past year, but also on the increased activity which has characterized its proceedings. Mention was made in the last Annual Report of a scheme which the Council had sanctioned for the formation of Sections or Sectional Committees for the more effective study of different subjects. The work of some of these will be dealt with more at large in the reports of their several secretaries; it may be mentioned, however, that the Microscopical Section has held seven meetings, which have been well attended, and the Council feels that the admirable series of demonstrations which Mr. D. E. Caush has given on different methods of cutting sections of animal tissues have been of the greatest value to the Society. The Botanical Section will be shortly placed on a better footing and with a more complete sectional organization. The Meteorological results furnished us by Dr. Newsholme, in which the rainfall and sunshine at Brighton are compared with neighbouring stations, cannot fail to be of present interest and a record of permanent value. But the great success of the year has been, without doubt, the institution of a Photographic Section, no less than thirty-five members having joined the Society or been proposed for membership within the last three months mainly with the object of attending the meetings of this Section. The Council gratefully acknowledges the efficient aid which the late Chairman of this Section (Mr. D. E. Caush), and the present Secretary (Mr. Walter Harrison), have rendered in organizing it. The acquisition of an electric lantern, together with a constant supply of electricity to the room in which we meet, permitting of its use at all times, has been not only a necessity of the Photographic Section, but a great help to the illustration of papers, &c., at our ordinary meetings.

The institution and organization of the different sections, to which allusion has been made, and their harmonious working has necessitated some alterations in, and additions to, the Rules and Regulations. The experience also of the five years which have elapsed since the last revision of them has suggested to the Council the advisability of certain modifications. The Bye-Laws which have thus been revised, and the new ones which have been inserted in our Code of Rules and Regulations, will, according to the notice sent out convening this meeting, now be submitted to you for your approval.

During the past year the Society has lost two members by death, viz., Mr. Alderman Hallett and Mr. W. Marchant. The former, who was a Vice-President of the Society, had been a Member for twenty years. Seventeen members have resigned or have left the town. On the other hand, thirty-two new members have been elected. The number now on the roll is 175.

The Papers read before the Society have been as follows:—

Oct. 14th, 1891.	Inaugural Address by the President (Mr. W. H. Rean): "The Microscope in Scientific Investigation."
Nov. 11th, ,,	"The Scientific Aspect of Folk-Lore": Mr. Henry Davey, Jun.
	At the conclusion of this paper a demonstration on "Mounting Microscopic Objects" was given by Mr. Caush.
Dec. 9th, ,,	"A Piano of Colours": Mr. L. Leuliette.
Jan. 13th, 1892.	"Micro-Photography," with a demonstration: Mr. D. E. Caush.
Feb. 10th, ,,	"Reminiscences of our Excursions, Archæological and Otherwise," with illustrations by the Electric Lantern: Mr. Walter Harrison.
Mar. 9th, ,,	"Projection of Microscopical Sections on the Screen by the Electric Lantern," with explanations by Mr. D. E. Caush, Mr. E. J. Petitfourt, and Mr. Lomax.
Mar. 23rd, ,,	On "Ringing and Finishing Microscopic Slides": Mr. D. E. Caush.
April 13th ,,	"Some of the more Remarkable Results obtained by the aid of Photography in Astronomical Research," with illustrations by the Electric Lantern": Edward Alloway Pankhurst.

May 11th, „	An evening for Conversation, the Exhibition of Specimens, &c.
June 8th, „	Annual General Meeting at 8 p.m., followed by an Ordinary Meeting at 8.30, at which Mr. E. J. Petitfourt read a paper on "Facts and Fictions about Barnacles."

EXCURSIONS.

The Annual Excursion took place on June 23rd last to Pevensey, Hailsham, Worthing, Hurstmonceux, and Windmill Hill.

Field Excursions.

1891.	July	Newick (Mr. Sclater's park and grounds).
„	Aug. 8th.	Goring.
„	Sep. 12th.	Steyning for Chanctonbury Ring.
„	Oct. 10th.	Hassocks and Ditchling.
1892.	April 9th.	Isfield.
„	May 14th.	Glynde and Lewes.

PHOTOGRAPHIC SECTION.

REPORT OF THE COMMITTEE

The Council having by a resolution passed on February 17th authorized the formation of a Photographic Section, a meeting of members interested in photography was called by Mr. Pankhurst on March 25th, when Mr. D. E. Caush, L.D.S., was elected Chairman, Mr. W. Harrison, D.M.D., Secretary, and the following gentlemen to serve on the Committee, viz., Messrs. G. Foxall, J. Hunter-Graham, W. W. Mitchell, J. P. Slingsby Roberts, and Mr. A. H. Corder. The Committee then proceeded to draw up certain rules and regulations for the government and procedure of the Section, which were subsequently duly confirmed by the Council. On the nomination of Mr. D. E. Caush as President of the Society, he resigned the post of Chairman of this Section, and, at a Special Meeting called on June 3rd, Mr. J. P. Slingsby Roberts was elected Chairman in his place, and Mr. A. H. Webling on the Committee.

The following is a list of the meetings held and of the papers which have been read before the Section :—

April 1st. Inaugural Address by Mr. D. E. Caush on Isochromatic Photography, illustrated by negatives, prints, and lantern slides.

April 2nd. On Retouching; or the artistic improvement of landscape negatives.

June 3rd. An Exhibition of Hand Cameras. Many different kinds were exhibited, including two which were designed and made by members. The "Hand Camera Prize Prints," from the late competition held by the proprietors of *Photography*, being on view.

The following excursions have taken place :—

April 23rd.	Barcombe Mills.
May 18th.	Arundel.
May 28th.	Cuckfield Park.
June 6th.	Bosham.

The attendance at the meetings and excursions has been very good.

WALTER HARRISON,
Hon. Sec. of the Section.

MICROSCOPICAL SECTION.

REPORT.

During the Session the Secretary has demonstrated the following methods of preparing animal tissues for the microscope.

Nov. 11th, 1891	Making cells and dry mounting.
Nov. 25th, ,,	Mr. T. Charters White's method of cutting, staining, and mounting in hard balsam.
Dec. 17th, ,,	Practical work by members of the Section.
Feb. 24th, 1892	Soft section cutting with Cathcart's freezing microtome and mounting in chloro-balsam.
Mar. 23rd, ,,	Finishing slides, covering with paper, ringing, &c.

April 27th, 1892. Staining for bacteria in sputum and tissue.
May 25th „ Mr. A. Hopewell Smith's method of cutting hard and soft Sections combined.

Much interest has been manifested by the members in the demonstrations given, and it is hoped that during the next session a still larger number will attend the meetings. It is proposed to give a series of demonstrations on preparing, staining, and mounting vegetable sections.

D. E. CAUSH,
Hon. Sec. of the Section.

BOTANICAL SECTION.

The following list of rare or uncommon plants found in Sussex this year has been drawn up by Mr. Thomas Hilton. Mr. Hilton remarks on the absence of *Trifolium Stellatum* from the neighbourhood of Shoreham during the last two years, and he suggests as the cause of its disappearance unfavourable climatic conditions. He thinks it probable that when these become more favourable the plant may again be found.

MAY.

Name of the Flower.	*Locality.*
Paris quadrifolia.	Harting.
Lathræa squamaria.	Harting.
Ranunculus Lenormandi.	Piltdown.
Myriophyllum alterniflorum.	Piltdown.
Viola palustris.	Chailey Common.
Hesperis matronalis.	Bolney.

JUNE.

Erysimum orientale.	Sompting.
Cephelanthera ensifolia.	Stanmer Park.
Asparagus officinalis.	Southwick Beach.
Aceras anthropophera.	Woolstonbury Hill.
Lycopsis arvensis.	Kingston-by-Sea.
Potamogeton pusillus.	Southease.
Thesium linophyllum.	Mount Caburn.
Ranunculus circinatus.	Southease.
Geranium pratense.	Hassocks.

JULY.

Name of the Flower.	*Locality.*
Thlaspi arvense.	Fishersgate.
Trifolium filiforme.	Hassocks.
Marrubium vulgare.	Brighton.
Limnanthemum peltatum.	Hamsey.
Lemna gibba.	Lewes.
Galium sylvestre.	Clayton (H. Hemmings).

AUGUST.

Statice auriculæfolia.	Cuckmere Haven.
Inula Helenium.	Edburton.

ENTOMOLOGICAL SECTION.

As a contribution towards a complete list of the Lepidoptera of Sussex, Mr. W. H. B. Fletcher, of Worthing, has printed together with the special localities, the record of his own captures and observations in West Sussex, which extends over many years.

It is to be hoped that by the co-operation of others interested in Entomology, an exhaustive list of the Lepidoptera of the County may eventually be compiled.

The record of Mr. Fletcher's above referred to is in the Society's Library.

METEOROLOGICAL SECTION.

The following tables, showing the temperature, wind, rainfall, sunshine, &c., at Brighton, have been drawn up by Dr. Arthur Newsholme (Medical Officer of Health for the Borough).

The chief facts as to the Meteorology of Brighton during the twelve months July, 1891-June, 1892, are set forth in Table I., and the comparison with the mean results for the 14 years 1877-90 can be made in detail. The year was an exceptionally wet one, there having been 32·60 inches as compared with the mean amount of 30·36 inches.

Table III., affording an interesting comparison between the meteorology of Crowborough and Brighton, has been compiled from the observations of Mr. C. Leeson Prince, whose admirable work in this direction, continued over a long series of years, is well known.

The Crowborough Observatory is 825 feet above sea level and distant about twenty-two miles from Brighton in a N.E. direction; the rain-gauge at Brighton is 32 feet above sea level. The rainfall is much greater at Crowborough. During the whole year, and especially during the winter months, the range of temperature is greater than at Brighton. The table gives an interesting example of the contrast between a seaside and a hilly and well-wooded neighbourhood.

TABLE I.

Month.		Temperature of Air during Month.				Mean Temperature of Air.	Mean degree of Humidity. Saturation=100.	Wind.									Rainfall.	
		Highest.	Lowest.	Mean of				Number of Days of									No. of days on which Rain fell.	Amount collected in inches.
				All Highest.	All Lowest.			N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm		
July,	1891 ...	72·5	47·5	68·8	54·6	61·7	62.	0	5	0	3	0	12	2	9	0	14	2·77.
,,	1877-90 ...	...	...	67·3	55·0	60·5	73.	1·6	2·9	0·9	1·8	1·8	13·2	4·8	3·6	0·4	13	2·44.
August,	1891 ...	68·8	46·0	65·8	55·0	60·4	75.	1	0	0	2	0	15	8	5	0	19	5·42.
,,	1877-90 ...	...	...	67·3	55·6	61·2	75.	2·5	4·7	1·5	2·2	1·2	8·6	5·4	4·3	0·6	12	2·59.
September,	1891 ...	78·0	45·7	66·3	54·7	60·5	65.	0	3	0	3	1	16	2	5	0	11	0·90.
,,	1877-90 ...	...	..	63·6	51·4	57·3	79.	3·7	6·2	1·2	2·0	1·6	6·6	2·0	5·0	0·7	12	2·62.
October,	1891 ...	64·4	32·0	57·8	50·8	53·9	64.	0	4	0	4	1	17	2	3	0	22	8·46.
,,	1877-90 ...	...	...	57·0	45·2	51·0	78.	4·2	6·6	1·9	2·1	1·6	5·6	2·9	5·3	0·6	15	3·84.
November,	1891 ...	56·0	31·2	50·4	40·8	45·6	64.	1	12	1	1	3	6	1	5	0	13	3·53.
,,	1877-90 ...	...	..	50·1	41·0	45·5	86.	3·0	5·3	1·1	1·3	2·3	7·9	3·6	5·0	0·5	16	3·61.
December,	1891 ...	54·0	26.0	48·0	38·4	43·2	90.	0	8	0	3	0	13	5	2	0	20	2·75.
,,	1877-90 ...	...	...	45·4	36·5	40·0	83.	3·9	6·3	0·9	1·7	1·8	7·2	3·4	5·6	0·2	14	2·47.
January,	1892 ...	51·4	20·2	42·2	32·9	37·5	96.	2	2	1	5	0	4	1	16	0	14	1·24.
,,	1877-90 ...	...	...	43·7	34·8	39·3	86.	3·3	6·5	1·9	2·3	2·6	6·6	2·6	4·9	0·2	15	2·83.
February,	1892 ...	51·5	21·0	44·7	35·9	40·3	90.	2	7	2	5	1	4	1	7	0	17	1·36.
,,	1877-90 ...	...	...	45·1	37·7	40·9	81.	3·0	4·7	1·6	2·4	2·2	6·2	3·6	3·8	0·4	14	2·28.
March,	1892 ..	58·0	23·5	45·0	32·9	38·9	76.	1	16	1	2	0	7	0	4	0	9	1·24.
,,	1877-90 ...	. .	...	48·0	35·6	41·7	81.	3·2	7·2	2·2	2·3	1·2	6·2	2·9	5·3	0·5	12	1·82.
April,	1892 ...	69·2	28·4	59·2	39·2	49·2	79.	0	12	4	4	0	5	1	4	0	7	1·86.
,,	1877-90 ...	...	...	52·7	40·5	46·8	81.	3·0	10·0	1·6	2·5	1·8	5·7	2·5	2·6	0·3	12	2·03.
May,	1892 ...	72·8	37·2	60·5	46·4	53·4	76.	0	10	0	4	1	11	2	3	0	8	1·10.
,,	1877-90 ...	...	...	59·3	46·0	52·4	73.	2·7	8·7	1·4	3·2	2·6	8·1	1·6	2·4	0·3	11	1·93.
June,	1892 ...	75·2	41·5	63·6	51·5	57·5	71.	0	5	0	4	0	11	6	4	0	10	1·97.
,,	1877-90 ...	...	...	65·6	52·5	58·8	72.	2·4	6·2	1·4	2·2	1·8	9·6	2·6	3·6	0·2	11	1·90.
Entire Year ...	...	78·0	20·2	56·0	44·4	50·2	75.	7	84	9	40	7	115	31	67	0	164	32·60.

TABLE II.

	HOURS OF BRIGHT SUNSHINE.			SUNLESS DAYS, 1891.		
	Brighton.	East-bourne.	Hastings.	Brighton.	East-bourne.	Hastings.
July, 1891 ...	214·3	214·4	220·5	0	2	2
August ...	161·5	152·0	157·9	3	3	2
September ...	161·9	173·6	171·9	3	4	3
October ...	120·2	124·1	125·1	7	8	9
November ...	69·4	57·4	74·5	9	9	5
December ...	74·2	80·1	79·7	9	10	9
January, 1892	60·1	82·0	81·2	9	10	11
February ...	80·9	66·8	68·1	8	10	8
March ...	146·5	142·3	148·1	3	2	2
April ...	231·7	235·1	234·6	1	1	2
May ...	228·9	236·0	245·8	1	0	1
June ...	232·5	237·0	242·1	1	0	1
	1782·1	1800·8	1849·5	54	59	55
Corresponding Total for July, 1890, to June 1891	1705·8	1703·4	1741·8	62	69	66

The returns for Eastbourne are based on figures furnished by Mr. R. Sheward, F.R.Met.S., and those for Hastings are furnished by Dr. Colborne.

Crowborough figures are taken from the Meteorological Journal of Mr. C. Leeson Prince, F.R.Met.S., &c.)

TABLE III.

Month.		Temperature of Air during Month. Highest.	Lowest.	Mean of All Highest.	Mean of All Lowest.	Mean Temperature of Air.	Mean degree of Humidity. Saturation = 100.	Wind. Number of Days of N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Rainfall. No. of days on which Rainfell.	Amount collected in inches.
January,	Brighton ...	52·7	20·2	40·5	31·5	36·0	93.	1	8	0	2	1	8	2	9	12	2·62.
,,	Crowborough..	49·0	18·3	37·9	29·3	33·6	91.	7	7	1	3	4	6	3	0		3·38.
February,	Brighton ...	55·3	28·0	47·4	34·0	40·7	91.	0	12	1	0	0	3	2	10	0	0.
,,	Crowborough..	66·6	27·0	47·6	33·4	40·5	80.	4	7	7	0	2	4	3	1		0.
March,	Brighton ...	62·4	27·4	40·5	35·9	41·2	83.	1	9	0	1	1	9	2	8	16	2·92.
,,	Crowborough..	58·8	23·3	44·4	32·4	38·4	80.	6	8	1	2	1	5	7	1		4·06.
April,	Brighton ...	64·3	29·5	51·3	38·8	45·0	80.	0	11	0	2	0	9	0	8	6	0·60.
,,	Crowborough..	63·6	29·4	50·4	34·8	42·6	72.	8	10	3	3	1	3	0	2		0·59.
May,	Brighton ...	75·2	33·5	58·6	44·7	51·6	75.	1	10	0	3	1	9	0	7	13	2·56.
,,	Crowborough..	75·8	29·5	58·6	41·0	49·8	79.	8	3	1	3	6	6	2	2		3·88.
June,	Brighton ...	74·8	42·0	66·6	52·5	59·5	88.	1	10	1	4	0	11	0	3	12	1·88.
,,	Crowborough..	78·4	39·5	67·9	50·1	59·0	74.	3	9	3	1	4	4	3	3		2·18.
July,	Brighton ...	72·5	47·5	68·8	54·6	61·7	62.	0	5	0	3	0	12	2	9	14	2·77.
,,	Crowborough..	78·0	43·2	67·8	51·0	59·4	78.	5	5	0	1	3	10	6	1		3·62.
August,	Brighton ...	68·8	46·0	65·8	55·0	60·4	75.	1	0	0	2	0	15	8	5	19	5·42.
,,	Crowborough..	74·0	44·2	66·0	50·4	58·2	84.	1	0	0	1	5	17	4	3		5·79.
September,	Brighton ...	78·0	45·7	66·3	54·7	60·5	65.	0	3	0	3	1	16	2	5	11	0·90.
,,	Crowborough..	78·5	43·2	65·6	51·2	58·4	82.	2	1	3	2	7	12	2	1		1·52.
October,	Brighton ...	64·4	32·0	57·8	50·8	53·9	64.	0	4	0	4	1	17	2	3	22	8·46.
,,	Crowborough..	64·7	30·0	56·0	44·6	50·3	88.	0	5	3	2	11	6	4	0		9·28.
November,	Brighton ...	56·0	31·2	50·4	40·8	45·6	64.	1	12	1	1	3	6	1	5	13	3·53.
,,	Crowborough..	53·6	30·3	46·7	37·1	41·9	90.	3	6	1	6	5	6	2	1		3·73.
December,	Brighton ...	54·0	26·0	48·0	38·4	43·2	90.	0	8	0	3	0	13	5	2	20	2·25.
,,	Crowborough..	52·0	24·8	45·0	35·8	40·4	94.	0	5	2	2	3	12	7	0		4·34.
Entire Year,	Brighton ...	78·0	...	55·6	44·3	49·9	77.	6	92	3	28	8	125	26	75	158	34·21.
,, ,,	Crowborough.	78·5	18·3	54·5	40·9	47·7	82.	47	66	25	26	52	91	43	15		42·37.

LIBRARIAN'S REPORT.

The year just concluded has been marked by events of considerable interest. The accessions to the Library during the year have been numerous and valuable, though on the whole less remarkable than in 1890-91, when vols. 15-23 of the Challenger Expedition Reports were among the purchases. These recent accessions include:—

Anderson: Anatomical and Zoological Results of the Yunann Expedition.
"A Son of the Marshes": Within an Hour of London Town.
Carpenter: The Microscope, edited by Dallinger.
Clerke, Agnes: History of Astronomy in the 19th Century.
" " System of the Stars.
Cooke: Fungi.
Guillemin: Electricity and Magnetism.
Hatch: Petrology.
Hudson: The Naturalist in La Plata.
Jennings: Photo-Micrography.
Mendeleef: Principles of Chemistry.
Mills: Photography Applied to the Microscope.
" Interior Photography.
Nautical Almanack for 1892-5.
North, Marian: Recollections of a Happy Life.
Pringle: Practical Micro-Photography.
Robinson: Pictorial Effect in Photography.
Schnaus: Photographic Pastimes.
Sully: The Human Mind.
Taylor, Traill: Optics of Photography and Lenses.
Werge: Evolution of Photography.
Woodward and Sherborn: Catalogue of British Fossil Vertebrata.
Year-Book of Science, The.
Also a number of Photographic Books purchased from Mr. Fox.

The number of borrowers has decidedly increased. After steadily falling in past years, down even to 80, it rose in 1890-91 to 114, and in the past year has reached 178. It is hoped that the exhibition at the ordinary meetings of new acquisitions to the Library will draw more attention to the valuable books at the service of the members, and will cause more general use of the Library.

The serials at present taken in are:—

Annals of Botany.
The Entolomogist.
Entomologists' Monthly Magazine.
Geological Magazine.
Proceedings of Geologists' Association.
Grevillea.
Nature.
Nature Notes.
Natural Science.
Palæontological Society's Publication.
Quekett Microscopical Club.
Royal Society's Publication.
Royal Microscopical Society.
Quarterly Journal of Microscopical Science.
Science Gossip.
The Zoologist.

The Society has been for some years past indebted to Mr. Henry Willett for his kind presentation of the Quarterly Journal of the Geological Society. We have again to acknowledge a munificent gift from Mrs. Woollams, who has presented lately to the Society the following works:—History of Astronomy in the Nineteenth Century, by Agnes Clerke; System of the Stars, by ditto; Introduction to Petrology, by Dr. Hatch; and Within an Hour of London Town, by "A Son of the Marshes."

HENRY DAVEY, Jun.,
Hon. Librarian.

Brighton and Sussex Natural History and Philosophical Society.

TREASURER'S ACCOUNT FOR THE YEAR ENDING 8TH JUNE, 1892.

Dr.

	£	s.	d.
By Balance in the hands of Treasurer, 10th June, 1891	52	14	11
,, Annual Subscriptions and Arrears to 1st October, 1892	68	10	0
,, Annual Subscriptions to 1st October, 1893, paid in advance	1	0	0
,, Entrance Fees	12	10	0
,, Overpayment of Subscriptions	0	1	6
,, Dividends on £100 $2\frac{3}{4}$ per cent. Stock to April 5th, 1892, one year	2	15	0
	£137	11	5

Balance in hands of Treasurer, June, 1892 (at Messrs. Hall, Bevan, West and Bevan's Bank) ... £64 5 1

NOTE.—*A sum of £100 is invested in £2 15s. per cent. Consolidated Stock in the names of the Treasurer and Honorary Secretaries, as Trustees for the Society* ... 100 0 0

Cr.

	£	s.	d.
To Books and Periodicals	12	15	0
,, Bookbinding	2	10	4
,, Printing Annual Report and Abstract of Proceedings	7	16	6
,, Printing and Stationery	7	6	11
,, Postages, &c.	12	14	0
,, Repairs to Bookcases	1	19	0
,, Cost of fittings (Electric Light) in Librarian's Room for use with Lantern	3	16	3
,, Subscriptions to Societies	2	14	11
,, Assistant Secretary's Salary	2	2	0
,, Commission to Collector for Subscriptions	3	3	0
,, Gratuities to Assistants at Museum	3	0	0
,, Expense of Annual Excursion	3	3	9
,, Electric Lantern and Accessories for use at Meetings	6	14	9
,, Books purchased (Mrs Woollams' Gift)	1	12	0
,, Cost of Tea and Coffee at Meetings	1	3	5
,, Fire Insurance	0	12	0
,, Cheque Book	0	2	6
,, Balance in hands of Treasurer, June, 1892	64	5	1
	£137	11	5

Examined 8th June, 1892.

F. G. CLARK,
HENRY DAVEY, } *Hon. Auditors.*

After the Reports and Treasurer's Account had been read it was moved by Mr. G. D. Sawyer, seconded by Mr. E. F. Salmon, and resolved—

"That the Reports and Treasurer's Account now brought in be received, adopted, entered on the minutes, and printed for circulation as usual."

It was moved by Mr. H. V. Shaw, seconded by Mr. E. Booth, and resolved—

"That the following gentlemen be Officers of the Society for the ensuing year :—*President :* Mr. D. E. Caush ; *Ordinary Members of Council :* Dr. A. Newsholme, M.R.C.S., Mr. E. J. Petitfourt, B.A., F.C.P., Mr. D. E. Caush, Mr. C. A. Wells, Mr. Walter Harrison, D.M.D., and Dr. W. J. Treutler ; *Honorary Treasurer :* Dr. McKellar, Woodleigh, Preston ; *Honorary Librarian :* Mr. Henry Davey, Junr. ; *Honorary Curator :* Mr. Benjamin Lomax, F.L.S. ; *Honorary Secretaries :* Mr. Edward Alloway Pankhurst, 12, Clifton Road, and Mr. Jno. Colbatch Clark, 64, Middle Street."

Mr. E. Booth moved, Dr. W. J. Treutler seconded, and it was resolved—

"That the sincere thanks of the Society be given to the Vice-Presidents, Council, Hon. Librarian, Hon. Curator, Hon. Treasurer, Hon. Auditors, and Hon. Secretaries for their services during the past year."

Mr. De Paris moved, Mr. Haselwood seconded, and it was resolved—

"That the best thanks of the Society be given to Mr. W. H. Rean, now retiring from the office of President, for his attention to the interests of the Society during the past year."

New Rules and Regulations recommended by the Council for adoption were then brought in. On the motion of Mr. E. A. Pankhurst, seconded by Mr. J. Colbatch Clark, it was resolved—

"That the foregoing rules be now received and adopted as the Rules and Regulations of the Brighton and Sussex Natural History and Philosophical Society, and be forthwith printed and distributed amongst the members and come into force on the 1st of October next."

The meeting was then resolved into an Ordinary Meeting.

SOCIETIES ASSOCIATED,

WITH WHICH THE SOCIETY EXCHANGES PUBLICATIONS,

And whose Presidents and Secretaries are *ex-officio* members of the Society :—

Barrow Naturalists' Field Club.
Belfast Naturalists' Field Club.
Belfast Natural History and Philosophical Society.
Boston Society of Natural Science (Mass., U.S.A.).
British and American Archæological Society, Rome.
Cardiff Naturalists' Society.
Chester Society of Natural Science.
Chichester and West Sussex Natural History Society.
Croydon Microscopical Society.
Department of the Interior, Washington, U.S.A.
Eastbourne Natural History Society.
Edinburgh Geological Society.
Epping Forest and County of Essex Naturalist Field Club.
Folkestone Natural History Society.
Geologists' Association.
Glasgow Natural History Society and Society of Field Naturalists.
Hampshire Field Club.
Huddersfield Naturalist Society.
Leeds Naturalist Club.
Lewes and East Sussex Natural History Society.
Maidstone and Mid-Kent Natural History Society.
North Staffordshire Naturalists' Field Club and Archæological Society.
Peabody Academy of Science, Salem, Mass., U.S.A.
Quekett Microscopical Club.
Royal Microscopical Society.
Royal Society.
Smithsonian Institute, Washington, U.S.A.
South London Microscopical and Natural History Club.
Société Belge de Microscopie, Bruxelles.
Tunbridge Wells Natural History and Antiquarian Society.
Watford Natural History Society.
Yorkshire Philosophical Society.

LIST OF MEMBERS

OF THE

Brighton and Sussex Natural History and Philosophical Society,

1892.

N.B.—Members are particularly requested to notify any change of address at once to Mr. J. C. Clark, 64, Middle Street, Brighton.

ORDINARY MEMBERS.

ABBEY, HENRY, Fair Lee Villa, Kemp Town.
ANDREWS, W. W., 10, Springfield Road, Preston.
ASH, VACY, M.B., L.R.C.P., 7, Rochester Gardens, Hove.

BROWN, J. H., 6, Cambridge Road, Hove.
BADCOCK, LEWIS C., M.D., M.R.C.S., Buckingham Place, Brighton.
BLACK, ARTHUR, B.Sc., 77, Goldstone Villas, West Brighton.
BOXALL, W. PERCIVAL, J.P., Belle Vue Hall, Kemp Town.
BALEAN, H., 15,Alexandra Villas, Brighton.
BOOTH, E., 70, East Street, Brighton.
BRINTON, ROBERT, 23, Middle Street, Brighton.
BLAKER, T. F. J., M.R.C.S., 92, London Road.
BABER, E. C., M.B., L.R.C.P., 97, Western Road, Brighton.
BURROWS, W. SEYMOUR, B.A., M.R.C.S., 62, Old Steine, Brighton.
BILLING, T., 86, King's Road, Brighton.
BARWELL, G. E., 32, St. George's Road, Brighton.
BALLARD, Rev. F., 8, Stanford Road, Brighton.
BEDFORD, E. J., School of Science and Art, Grand Parade, Brighton.
BEVAN, BERTRAND, Withdean, Preston.

CLARK, JOHN COLBATCH, 64, Middle Street, Brighton.
COX, A. H., J.P., 35, Wellington Road, Brighton.

Caush, D. E., 63, Grand Parade, Brighton.
Chapman, E., 34, Upper North Street, Brighton.
Coningham, W. J. C., 6, Lewes Crescent, Kemp Town.
Clark, F. G., 56, Ship Street, Brighton.
Cowell, Samuel, 143, North Street, Brighton.
Couchman, J. E., Down House, Hurstpierpoint.
Cornford, L. C., Windlesham House, Norfolk Terrace, Brighton.
Carmouche, H., 71, King's Road, Brighton.
Constable, S., 9, Market Street, Lewes.

Dennant, John, 1, Sillwood Road, Brighton.
Davey, Henry, J.P., 82, Grand Parade, Brighton.
Dennet, C. F., 1, St. George's Place, Brighton.
Davis, H. C., 39, St. James's Street, Brighton.
Day, Rev. H. G., M.A., 55, Denmark Villas, West Brighton.
Denman, Samuel, 26, Queen's Road, Brighton.
Dodd, A. H., L.R.C.P., M.R.C.S., 14, Goldstone Villas, Hove.
Davey, Henry, Junr., 8, Norfolk Road, Brighton.

Edmonds, H., B.Sc., Mount Caburn, Ditchling Road, Brighton.
Ewart, J., M.D., F.R.C.P., M.R.C.S., F.Z.S., Montpelier Hall, Brighton.
Earp, F., 37, Upper Rock Gardens, Brighton.

Friend, D. B., 35, Ditchling Road, Brighton.
Fletcher, W. H. B., Fair Lawn House, Worthing.
Fowler, H., 18, Goldsmid Road, Brighton.
Foxall, G., Woodlands, Port Hall Road, Brighton.

Glaisyer, Thos., 96, London Road, Brighton.
Goldsmid, Sir Julian, Bart., M.P., 105, Piccadilly, London.
Grove, Edmund, Norlington, Preston.
Griffith, Arthur, 15, Buckingham Place, Brighton.
Graham, J. H., 8, Alexandra Villas, Brighton.

Haselwood, J. E., 3, Lennox Place, Brighton.
Hart, E. J. T., M.R.C.S., 4, Gloucester Place, Brighton.
Hurst, H., 149, North Street, Brighton.
Hobbs, James, 62, North Street, Brighton.
Hack, D., 15, Market Street, Brighton.
Hollis, W. Ainslie, M.D., F.R.C.P., 8, Cambridge Road, Hove.
Holder, J. J., 8, Lorne Villas, Preston Park.
Haynes, J. L., 49, Shaftesbury Road, Brighton.

Henriques, A. G., F.G.S., 9, Adelaide Crescent, Hove.
Harrison, Walter, D.M.D., 98, Western Road, Brighton.
Hodgson, Dr., 35, Montpelier Road, Brighton.
Howlett, J. W., 4, Brunswick Place, Hove.
Hudson, Rev. Robt., M.A., 9, The Drive, Hove.
Harding, N., Wynnstay, Stanford Avenue, Preston.
Horniman, F. J., Surrey Mansion, Eastern Terrace, Brighton.
Hardcastle, S. B., 71, East Street, Brighton.
Harrison, F. M., 14, Queen's Road, Brighton.
Histed, E., 2 and 3, Upper St. James's Street, Brighton.
Hilton, Thomas, 16, Kensington Place, Brighton.
Hamilton, T. Lawrence, M.R.C.S., 30, Sussex Square, Brighton.

Infield, H. J., 130, North Street, Brighton.

Jacomb, Wykeham, 72, Dyke Road, Brighton.
Job, C., 2, Club Mansions, Third Avenue, West Brighton.
Johnson, J., 24, Norfolk Square, Brighton.
Jerrard, J., 16, Goldsmid Road, Brighton.

Kilmister, Charles, F.R.H.S., 56, Buckingham Road, Brighton.
Knight, John J., 33, Duke Street, Brighton.

Leulliette, L., 18, Buckingham Road, Brighton.
Lomax, Benjamin, F.L.S., C.E., Free Library, Brighton.
Langton, Herbert, M.R.C.S., 11, Marlborough Place, Brighton.
Loder, Gerald W. E., M.P., Abinger House, Brighton.
Laing, Samuel, 19, Brunswick Terrace, Hove.
Lewis, J., 37, Preston Road, Brighton.

Marshall, E. J., 78, Buckingham Road, Brighton.
Merrifield, F., 24, Vernon Terrace, Brighton.
Mitchell, W. W., 23, Ditchling Rise, Brighton.
Medcalf, E. S., L.R.C.P., M.R.C.S., 16, Hova Villas, Hove.
Mead, W., 119, Church Road, Hove.
McKellar, Edward, M.D., Woodleigh, Preston.
Martin, W. H., 18, Gloucester Place, Brighton.
Marriott, Right Hon. Sir W. T., Q.C., M.P., 56, Ennismore Gardens, London, S.W.
Mant, Charles F., 61, Buckingham Road, Brighton.
Morgan, G., L.R.C.P., M.R.C.S., 45, Old Steine, Brighton.

Nye, J. K., St. George's House, St. George's Place, Brighton.
Newsholme, A., M.D., M.R.C.S., 15, College Road, Brighton.
Norman, S., Burgess Hill, Sussex.

Pankhurst, E. A., 12, Clifton Road, Brighton.
Puttick, W., The Ferns, Woodlands Road, Hassocks.
Petitfourt, E. J., B.A., F.C.P., 8, Sudeley Street, Brighton.
Paris, George De, 5, Denmark Terrace, Brighton.
Prince, H., 12, Middle Street, Brighton.
Pears, H. Kilby, Junr., 16, Western Road, Hove.
Pugh, Rev. Charles, 107, Marine Parade, Brighton.
Payne, W. H., 6, Springfield Road, Brighton.

Rutter, J., M.D., M.R.C.S., 142, Western Road, Brighton.
Ross, Douglas M., M.B., M.R.C.S., 9, Pavilion Parade, Brighton.
Rean, W. H., M.R.C.S., 36, Vernon Terrace, Brighton.
Rose, T., Clarence Hotel, North Street, Brighton.
Roberts, J. P. Slingsby, 3, Powis Villas, Brighton.
Rodgers, J. C., Villa Friedrichstein, Fahr, Neuwied-on-Rhine.
Reynolds, H. L., Southover, West Worthing.

Sawyer, G. D., F.R.M.S., 55, Buckingham Place, Brighton.
Smith, C. P., 9, North Street, Brighton.
Smith, T., 85, Church Road, Hove.
Smith, W., 6, Powis Grove, Brighton.
Strevens, W. H., 95, Western Road, Brighton.
Savage, W. W., 109, St. James's Street, Brighton.
Shaw, H. V., 10, Norfolk Terrace, Brighton.
Stephens, W. J., L.R.C.P., 41, Grand Parade, Brighton.
Salmon, E. F., 30, Western Road, Hove.
Spong, Rev. A. D., 19, Ventnor Villas, Hove.
Stoner, C. Berrington, D.D.S., Philadelph, L.D.S., Rio Lodge, Brighton.
Stuart, A. J., 43, Brunswick Place, Hove.

Thomas, D., 53, King's Road, Brighton.
Thomas, J., 28, Old Steine, Brighton.
Treutler, W. J., M.D., 8, Goldstone Villas, Hove.
Tanner, T. Slingsby, 104b, Mount Street, Berkeley Square, London.

Uhthoff, J. C., M.D., F.R.C.S., M.R.C.P., 9, Brunswick Place, Brighton.
Upton, Alfred, L.R.C.P., M.R.C.S., Rio Lodge, Brighton.

Verrall, Henry, 26, Gloucester Place, Brighton.

Willett, Henry, F.G.S., Arnold House, Montpelier Terrace Brighton.
Winter, J. N., M.R.C.S., 28, Montpelier Road, Brighton.
Wallis, Marriage, Springfield, Preston.
Wood, W. R., 3, Pavilion Buildings, Brighton.
Wood, J., 21, Old Steine, Brighton.
Williams, H. M., LL.B., 17, Middle Street, Brighton.
Wallis, W. C., 15, Market Street, Brighton.
Wilkinson, T., 168, North Street, Brighton.
Wood, Frederick, 12, Lewes Crescent, Kemp Town.
Walter, John, 13a, Dyke Road, Brighton.
Whittle, E. G., M.D., F.R.C.S., 9, Regency Square, Brighton.
Wells, C. A., 1, High Street, Lewes.
Wells, Isaac, 4, North Street, Brighton.
Woodruff, G. B., 24, Second Avenue, Hove.
Whytock, E., 36, Western Road, Brighton.
Waring, F. J. A., M.D., 8, Eaton Road, Hove.
Walter, John, Junr., 13a, Dyke Road, Brighton.
Webling, A. H., Hildrop, Hove Park Villas, Hove.
Williamson, J., 144, Church Road, Hove.
Wright, W., 8, Prince's Terrace, Kemp Town.
Weston, S. J., 24, Church Road, Hove.
Woodbury, A., 55, York Road, Hove.

LADY MEMBERS.

Bagley, Miss, Heidelberg House, 38, Medina Villas, Hove.
Caush, Mrs., 63, Grand Parade, Brighton.
Dagg, Miss, 1, Marlborough Place, Brighton.
Head, Miss, The High School, Montpelier Road, Brighton.
Herring, Miss, Heidelberg House, 38, Medina Villas, Hove.
Harrison, Mrs., 98, Western Road, Brighton.
Jerrard, Mrs., 16, Goldsmid Road, Brighton.
Lawrence, Miss P., 36, Sussex Square, Brighton.
Nash, Miss A. K., 8, Clermont Terrace, Brighton.
Scott, Mrs., 75, Montpelier Road, Brighton.
Treutler, Mrs., 8, Goldstone Villas, Hove.
Woollams, Mrs. Henry, 84, Avenue Road, Regent's Park, N.W.
Wooldridge, Mrs., Effingham Lodge, Withdean.

HONORARY MEMBERS.

ARNOLD, REV. F. H., The Hermitage, Emsworth.
BLOOMFIELD, REV. E. N., Guestling Rectory, Hastings.
CLARKSON, REV. G. A., Amberley, Sussex.
CURTEIS, T., 244, High Holborn, London.
GORDON, REV. PREBENDARY, Harting Vicarage, Midhurst.
JENNER, J. H. A., East Street, Lewes.
MITTEN, W., Hurstpierpoint, Sussex.
NORMAN, C.
NOURSE, W. E. C., Bouverie House, Mt. Radford, Exeter.
PHILLIPS, BARCLAY, 7, Harpur Place, Bedford.
PRINCE, C. L., The Observatory, Crowborough, Sussex.

BRIGHTON AND SUSSEX

Natural History & Philosophical Society.

RULES AND REGULATIONS

Adopted at the Annual General Meeting, held on June 8th, 1892, and ordered to come into force on the 1st October following.

Name of the Society.

1. The Society shall be called "The Brighton and Sussex Natural History and Philosophical Society."

Objects of the Society.

2. To promote the study of Natural History, Geology, the Physical and Applied Sciences, and Philosophy, by means of periodical Meetings, Excursions, publication of its transactions, the maintenance and extension of its present Library, and by such other means as the Council may from time to time think proper.

Members.

3. The Society shall consist of Ordinary and Honorary Members and of Associates. No person under 17 years of age shall be admitted either as Member or Associate.

Election of Ordinary Members.

4. Every Candidate for Membership must be recommended by at least two Members, to one of whom he must be personally known, and who shall give his full name and address.

5. The names and addresses of such Candidates shall be read by one of the Secretaries at any Meeting at which business can be competently transacted, and shall be printed in the circular calling the ensuing Meeting, at which the vote shall be taken.

6. Ladies may become Members of the Society, with the same duties and privileges as other Members.

7. Candidates shall be elected by Ballot, and when more than one is to be elected at any meeting the Ballot shall be taken separately on the demand of any Member present. Three black balls to exclude from Membership.

8. A copy of these Rules and Regulations shall be sent to every Member and Associate on election, and the payment of his or her Subscription thereafter shall be deemed an acceptance of the terms and conditions of Membership herein laid down.

Honorary Members.

9. Persons residing, and continuing to reside, five miles or more beyond the limits of the Parliamentary Borough of Brighton, and communicating any interesting matter to, or who are likely to promote the objects and interests of, the Society; as also Officers of kindred Societies, non-residents in Brighton, may be elected Honorary Members in the same way as ordinary Members; but shall not be required to pay any Entrance Fee or Subscription, subject to a power to be vested in the Council of terminating such Honorary Membership at any time.

10. Honorary Members shall only be entitled to attend the Meetings and Excursions of the Society; but shall not be entitled to vote or hold office. Honorary Members, on a visit to Brighton, shall have the privilege of attending the Meetings of the Society for a period not longer than four months at any one time.

Associates.

11. The Council shall have power to admit persons interested in Natural History, or any of the subjects which come within the scope of the Society, as Associates. Associates shall pay a Subscription of 2s. 6d. per annum. They shall be elected by the Council for the current year of the Society only, but shall be eligible for re-election. They shall be entitled to attend the ordinary Meetings and Excursions of the Society, but shall not be allowed to vote nor hold any office.

Subscriptions.

12. Every gentleman elected an ordinary Member shall pay an Entrance Fee of 10s. and both Ladies and Gentlemen elected as ordinary Members shall each pay an Annual Subscription of 10s., such Subscription to be payable in advance, and the first payment to date from the 1st of October preceding the Election, except the Election take place from the 1st of April to the 30th of September, both inclusive, when it shall date as on the 1st of October following.

13. If any Member whose Subscriptions shall be in arrear for two years shall neglect to pay the same within a month after notice of such arrear has been sent to him or her by one of the Secretaries, he or she shall be liable to be removed from the Society by the Council, if they think proper so to do, without further notice; but no forfeiture of Membership shall exonerate such persons from the payment of all moneys due to the Society.

14. A Member whose Subscription is 12 months in arrear shall not be entitled to hold office, vote, use the Library, or receive the publications of the Society; but no proceedings of the Council or the Society shall be vitiated or rendered void by reason of any Member acting contrary to this Rule.

15. A Member wishing to resign shall send a written notice to that effect to one of the Secretaries of the Society, but shall be

liable for all Arrears of Subscriptions and for the Subscription for the year ending on the 1st of October next following the date of such notice.

16. An ordinary Member may, in lieu of an Annual Subscription of 10s., compound for the same by a payment of £5, which sum shall be a Life-Subscription,

Government of the Society. Council and Office Bearers.

17. The Officers of the Society shall be a President, Vice-Presidents, Treasurer, Secretaries, Librarian, Curator, and such other Officers, with such duties attached thereto as the Council may from time to time decide upon.

18. The Management of the affairs of the Society shall be entrusted to a Council consisting of the aforesaid Officers, together with the Chairmen of all the duly authorised Sections, and six ordinary Members, who shall be chosen annually at the General Meeting in June. The Council shall have full power to settle all disputes arising out of the business or management of the Society, to remove, suspend, or reinstate any Officer of the Society, to fill up vacancies in the Council occurring at other times than at the Annual Meeting, and generally to superintend and govern the affairs of the Society in accordance with these Rules.

19. At the Annual General Meeting in June the Council shall submit to the Members a Report on the work of the Society during the past year.

20. In any circumstances which may arise, not provided for in these Rules, the Council shall act and determine as shall seem to it most expedient in the interests of the Society.

21. The Council shall meet monthly during the Session, five Members to form a quorum.

Removal of the Name of Members and Associates from the Roll of the Society.

22. Any Member or Associate may be removed from the Society by the Council, for causes other than those specified in Rule 13, if, at a Special Meeting of the Council, called to consider the question, a majority of not less than two-thirds of the whole number of the Council, vote for such removal.

Election of the Council.

23. A Special Meeting of the Council shall be convened not less than three weeks before the Annual Meeting in June. At such Special Meeting the President and the other Officers of the Society for the ensuing year to be recommended by the Council for election by the Society at the Annual Meeting shall be nominated. Of the six ordinary members who are already on the Council the two who are Senior according to date of election shall retire, and the Council shall choose two other Members in their place.

24. The two retiring Members shall not be eligible for re-election until the next Annual Meeting.

25. The Council shall also select from the Past-Presidents of the Society not less than three nor more than nine to be Vice-Presidents of the Society for the ensuing year.

26. The Chairman of every duly authorised Section shall be *ex-officio* a member of the Council.

27. The same person cannot hold office as President of the Society for more than two years in succession.

28. The President shall not, during his term of office, hold the office of Chairman or Secretary of any Section.

29. With the notice summoning the Annual General Meeting, a list of all the Officers and other Members of the Council so nominated as aforesaid shall be sent to every ordinary Member, and such notice of the Annual Meeting shall be posted at least eight days before the day for which it is summoned.

30. Any Member wishing to propose at the Annual Meeting any alteration in the list of Officers and Members nominated by the Council, or to make any other proposal, may do so by giving at least four clear days' notice to one of the Secretaries of his intention to do so, and stating in such notice the alteration or proposal he intends to make. Unless such a notice is given no amendment in such list nor any proposal shall be received.

31. The election of Officers and Members of the Council shall be by show of hands, unless the Meeting shall otherwise determine.

32. Should any Members of the Council, elected under Rule 23, fail to attend the Meetings of the Council for twelve months, without assigning sufficient reason for their absence, they shall *ipso facto* be held to have resigned their seats on the Council, and the Council at its next meeting may proceed to the election of another Member or Members to supply their place.

33. The President and Office-bearers of the Society, elected at the Annual General Meeting in June, shall enter on their duties at the Opening Meeting of the Session in October.

Committees and Sections.

34. The Council may appoint Committees for the Management of any particular business or may institute Sections for the encouragement and prosecution of any particular study.

35. A Section thus appointed may have an organisation of its own, with Chairman, Committee, and Secretary elected by the Members of that Section, in which case the Secretary shall keep a minute book of the proceedings of the Section and report to the Council from time to time as may be ordered its resolutions and proceedings for approval and confirmation.

36. No appointment of Chairman or Secretary of a Section shall be valid without the approval of the Council.

37. All Committees and Sections shall be constituted for one year only, and in the week preceding the Meeting of the

Council, specified in Rule 23, Sections shall proceed to the election of their Committee and Office-bearers, and the result of that election shall be reported forthwith to one of the Hon. Secretaries of the Society.

38. The President and Hon. Secretaries of the Society are *ex-officio* Members of all Sections and Sectional Committees, and shall have notice sent to them of all Meetings convened by Secretaries of Sections.

Duties of Officers.

39. The President shall take the Chair at all Meetings of the Council and at all Ordinary Meetings of the Society (Sectional Meetings are presided over by their own Chairmen). In his absence, one of the Vice-Presidents shall take the Chair; and, failing them, any Member who may be elected by the Meeting.

40. The decision of the Chairman presiding at any Meeting shall be conclusive and binding on such Meeting.

41. The Secretaries shall record the proceedings in the Minute Book and conduct the correspondence of the Society. They shall keep an accurate list of the names and addresses of all Members of the Society, and prepare the Proceedings and Transactions of the Society for publication. All communications received by them shall be laid before the Council at the earliest opportunity.

42. The Treasurer shall keep an account of all the moneys received by himself or the Secretaries and of all payments made on behalf of the Society. He shall prepare a Balance Sheet, duly audited by two Members of the Society appointed by the Council, to be presented at each Annual General Meeting in June.

43. The Librarian shall have the general charge of the books and periodicals belonging to the Society. He shall receive, acknowledge, and record all Donations presented to the Library, and shall see that all Works intended for the Society's Library are duly entered in a book provided for the purpose, labelled, numbered, and placed in the Library for the use of the Members. The Librarian shall submit annually to the Council a Report on the condition of the Library, the circulation of the books, and a list of the Donations made to the Library.

44. The Curator shall take charge of the Microscopes, Philosophical Apparatus, and such other property belonging to the Society as is not under the charge of the Librarian (unless otherwise ordered by the Council), and shall report to the Council, at the Meeting specified in Rule 23, on the state and condition of such property, of which he shall keep a full and complete catalogue.

Meetings Ordinary and Special.

45. The opening Meeting of the Session shall, unless otherwise ordered by the Council, take place on the second Wednesday in October, and the Session close, as far as the ordinary Meetings

of the Society are concerned, on the second Wednesday in June. At the commencement of the opening Meeting of the Session, the retiring President shall take the chair, and shall at once proceed to introduce the newly-elected President to the Meeting, who, after the usual formalities have been observed, shall deliver his inaugural address.

46. The Ordinary Meetings shall take place on the second Wednesday in the Month and shall be held in Brighton, but, in addition thereto, the Council are authorised to arrange from time to time for such extra Meetings, either Occasional or Regular, as they may think desirable, and to hold such extra Meetings, or any or either of them, at Hove or Brighton, as they may deem most advisable in the interests of the Society.

47. A Special General Meeting may be called at any time by the Council, and shall be called by the Honorary Secretaries on the requisition in writing of Five Members of the Society, given to one of the Secretaries at least 14 days before such intended Meeting, stating the object of such Meeting, and notice thereof shall be given to every ordinary Member at least one week previously.

48. A discretionary power shall be vested in the Council to alter the place and time of all Meetings of the Society.

49. Each Member may introduce a Visitor to the Society's Meetings, and the name of every person so introduced shall be communicated to the President for the evening and announced by him from the Chair.

Order of Business at Ordinary Meetings.

50. The order of business at the Ordinary Meetings of the Society shall be as follows :—

The Minutes of the previous Meeting shall be read, amended if required, and approved of.
Members proposed shall be voted for.
New Members shall be introduced to the President.
Applications for Membership shall be announced.
Names of Visitors to be announced by the President.
Papers and communications shall be read and discussed.
Specimens may be exhibited and described.

Papers and Discussions.

51. In all papers read before the Society, and in all discussions at its Meetings, party politics and controversial theology are excluded.

52. The decision with regard to the fitness of any Paper to be read before the Society rests with the Council.

53. Any Paper read before the Society *ipso facto* becomes in so far the property of the Society that it may be published whole or in part, as the Council may determine, in the Society's proceedings.

Annual General Meeting.

54. The Annual General Meeting of the Society shall be held on the second Wednesday of June in each year.

55. The Order of Business at this Meeting shall be as follows:

One of the Secretaries shall read the report of the Council on the past year.

The Treasurer shall read a statement of the financial affairs of the Society.

The Librarian shall report on the state of the Library, the circulation of books, &c.

The Society shall then proceed to the Election of Officers of the Society, and then to such Business as is appointed in the foregoing Rules to be transacted at the Annual General Meeting.

Excursions.

56. Annual Excursion.—On one day in each year the Members shall be invited to join in an Excursion to some interesting locality, and the Secretaries shall, if possible, make arrangements for the Annual Dinner at the same time in connection with such Excursion.

57. Field Excursions.—On one day in each month from May to September inclusive, a Field Excursion shall be arranged by the Council, due notice of which shall be given to the Members.

58. Friends of Members are only allowed to take part in the Annual and Field Excursions with the permission of one of the Secretaries.

Alteration of Rules and Regulations.

59. No new Rule or Regulation, nor any alteration or repeal of the existing Rules and Regulations of the Society, shall be made except at the Annual General Meeting in June, or at a Special Meeting called for the purpose, of which notice must be sent to every Member of the Society, together with a copy of the new Rule, or alteration or repeal proposed, at least eight days before the date appointed for such Special Meeting.

Microscopic Slides.

60. On application to the Science Secretary a Member may have on loan, for not longer than ten days, nor more than 15 of the Society's Microscopic Slides; the numbers of such Slides to be entered in a book provided for the purpose in charge of the said Secretary. The borrower shall be held accountable for all damage done to the Slides while in his or her possession, and shall pay such amount as the Council may determine in order to make good the same.

Instructions and Rules for the Use of the Library.

61. The Library of the Society is placed in the Free Public Library, Church Street, Brighton, and may be used there by

the general public in the same manner and under the same regulations as the Reference Library.

62. The Members of the Society have also the privilege of having books out of the Society's Library on loan, subject to the following Rules :—

1.—When a Member requires to have a book upon loan, application must be made at the counter in the Reading Room of the Reference Library, either by the Member personally, or by some one on his behalf, duly authorised in writing, according to a printed form which can be obtained at the counter. The title of the book required must be clearly written by the applicant on a printed form provided for the purpose; and when the book is returned the Member must take care to get a counterfoil from the Librarian, as he will be responsible for the book until he obtains such counterfoil.

2.—All books had by Members on loan must be returned at the expiration of fourteen days, but the loan may be renewed, if required, provided no other Member has made previous application for the book, but if more than one renewal is required, special permission must be obtained from the Librarian of the Society.

3.—No Member shall be allowed to have on loan more than one work at a time, without permission from the Society's Librarian.

4.—Any Member having had a book out for a fortnight, and detaining it after it has been applied for by the Honorary Librarian, shall be fined threepence per day for each volume so detained.

5.—Each Member shall be held accountable for and shall make good any injury to or loss of any volume or series of volumes belonging to the Society while in his possession.

6.—Any Member who may notice an imperfection of any volume belonging to the Society is requested to make the same known to the Librarian.

7.—No ink shall be used in taking notes, nor shall any tracing be made from plates without special permission.

8.—To admit of an annual scrutiny of the Library. all books, &c., shall be returned to the Librarian on the first Monday in May, and shall not be re-issued until the Monday following.

9.—Books may be obtained on such days as the Public Reference Library is open to the Public, between the hours of 10 a.m. and 10 p.m.

NOTE.—The room in which the Society's Library is placed is the private business room of the Librarian of the Public Library. Members are requested to observe the Rule requiring all applications to be made at the counter of the Library, and when referring to books to use the Public Reading Room, which will be found in every respect convenient.

Brighton and Sussex Natural History and Philosophical Society.

ABSTRACTS OF PAPERS

READ BEFORE THE SOCIETY,

TOGETHER WITH THE

ANNUAL REPORT

FOR THE

YEAR ENDING JUNE 14TH, 1893.

Brighton:
THE SOUTHERN PUBLISHING COMPANY, LIMITED, 130, NORTH STREET.

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OFFICERS OF THE SOCIETY.

1893-1894.

President:

Dr. A. Newsholme, M.R.C.P.

Vice-Presidents:

Mr. W. E. C. Nourse,
Mr. F. Merrifield,
Mr. Alderman Cox, J.P.,
Mr. J. Dennant,
Mr. G. D. Sawyer,
Dr. L. C. Badcock,
Mr. Thomas Glaisyer,
Rev. H. G. Day, M.A.,
Dr. W. Ainslie Hollis, F.R.C.P.,
Mr. Alderman J. Ewart, M.D., F.R.C.P., J.P.,
Mr. W. Seymour Burrows, M.R.C.S.,
Mr. J. E. Haselwood,
Mr. George de Paris,
Mr. W. H. Rean, M.R.C.S.,
Mr. D. E. Caush, L.D.S.

THE COUNCIL.

President:

Dr. A. Newsholme, M.R.C.P.

Vice-Presidents:

(Rule 20).

Mr. G. D. Sawyer,
Rev. H. G. Day,
Dr. W. Ainslie Hollis, F.R.C.P.,
Mr. Alderman J. Ewart, M.D., F.R.C.P., J.P.,
Mr. J. E. Haselwood,
Mr. Seymour Burrows, M.R.C.S.,
Mr. George de Paris,
Mr. W. H. Rean, M.R.C.S.,
Mr. D. E. Caush, L.D.S.

Ordinary Members:

(Rule 18).

Mr. Walter Harrison, D.M.D.,
Dr. W. J. Treutler,
Mr. C. A. Wells,
Mr. E. F. Salmon,
Mr. W. Clarkson Wallis,
Mr. Joseph Lewis.

Honorary Treasurer:

Dr. E. McKellar.

Honorary Auditors:

Mr. F. G. Clark, F.C.A.,
Mr. Alderman H. Davey, J.P.

Honorary Librarian:

Mr. Henry Davey, Junr.

Honorary Curator:

Mr. Benjamin Lomax, F.L.S.

Honorary Secretaries:

Mr. Edward Alloway Pankhurst, 12, Clifton Road,
Mr. Jno. Colbatch Clark, 64, Middle Street.

SESSION 1892-3.

WEDNESDAY, OCTOBER 11th, 1892.

INAUGURAL ADDRESS

BY

MR. D. E. CAUSH

(President of the Society).

Ladies and Gentlemen—

Allow me to thank you most heartily for the honour you have conferred upon me, in electing me to the exalted position of President of the Brighton and Sussex Natural History and Philosophical Society, and to assure you that it will be my earnest endeavour, during my term of office, to further the efforts of your Council in the development of this, our Society.

During the past year great changes have taken place in the working of this Society, and it now remains with the individual members, to make the effort of your Council a great and lasting success. Recognising the necessity of making some arrangements for the systematic study of the various branches of science embraced by our Society, the Council have organised various sections, each to have a definite subject for study. I am glad to say the following Sections are now in working order, viz.: Meteorology, Microscopy, Botany, and Photography, and it is to be hoped that Entomology and Geology will find sufficient supporters to justify a similar organisatiou also for these studies.

My predecessor in this chair devoted the greater portion of his address to the benefits to be derived from Microscopical studies; at the risk of a little reiteration, I am going still further to speak of them, in order to endeavour to bring home to my hearers, some of the pleasures and advantages to be derived from work, in which, I have myself, for many years, taken the greatest interest. The Microscopical Section which has lately been

formed, has been attended with so much success, as to afford great encouragement, and to raise our hopes that the scheme I have alluded to is a step in the right direction. Each section has its own Chairman and Secretary and a small Committee on whom it devolves to arrange the work of the Section. By the establishment of the Microscopical Section much interest has been created in the subject of Microscopy, and many of the members have met together for mutual instruction and I trust no little pleasure and benefit has accrued to them therefrom.

I may remark, that all the sections are open to every member of the Society, and all will be cordially welcomed to any of the sectional meetings, but these meetings will not be notified to any of the members, unless they give in their names to the Secretary, specifying the section, or sections, they wish to attend.

Let me now give you a little sketch of the work which it is proposed to do in some of the sections or of that which I trust may be done.

In the Photographic Section, elementary work will be taken up, as exposure, development, the various methods of printing &c., it is also the desire of its members to take up special methods, as lantern slide making, flower studies, photomicrography, enlarging, &c., and to increase the interest in the work, they have instituted among themselves a series of competitions, medals and certificates will be given for the best work in the studies enumerated.

In the Botanical section there is a large field open, both for winter and summer work. If, during the coming summer, the members of this section would make their special object the formation of a county herbarium, what lasting benefits they would confer, not only upon the botanists of our county, but upon the botanists of our country, while that which is all but impossible to the individual is possible to a number working together with a common aim. If such a work were begun, we may look, I am sure, for help from botanists, who at present are not members of our Society, yet who would with pleasure associate themselves with us, by sending specimens from the districts in which they reside. Such a work would, of course, take a large amount of time and thought in the proper arrangement of all the details of such a scheme, in the mapping out of districts, sub-districts, &c., and here, if necessary, we could get the help of kindred societies in the county, and by exchange with them enrich our collection with many specimens, otherwise only obtainable under great difficulties; yet we are convinced, that if the

section would but heartily take up the work, it would be accomplished within a reasonable time. How invaluable such a collection would be to our town! For such an herbarium under the care of our genial curator, would make our valuable museum far more valuable, not only to the scientist but to those so desirous of advancing education.

The field for winter work, is, if possible, larger still, there is before us the study of the microscopic structure of plants, and here our microscopic slides, already in the cabinet, would be invaluable. Again, what time we could devote to the functions of the various organs of plants and further, there is awaiting our attention, the mosses, lichens, desmids, diatoms, and algæ, of our county.

To those taking up practical botanical work, we would draw their attention to an invaluable book in our Library on "Practical Botany" by Strasburgher and Hillhouse.

In the Microscopical Section, during the last Session, some elementary work has been done in cutting and mounting animal tissues, and I trust that a course of demonstrations will be given during the coming year, on cutting and mounting vegetable tissue, but in Microscopy the difficulty lies in the very abundance of our material and in the many and varied lines of research that are open to us on every side.

I should like, therefore, with your permission, to devote the few minutes at my disposal to some of the revelations of the microscope; at no time has there been greater facilities, or greater inducements to undertake original work with it than at the present, moreover, it is now used more in the arts and trades than it ever has been. While the field for original observation is absolutely unlimited, its use, not only brings enlightenment to ourselves, but is a source of endless amusement to our friends.

Who could have understood, for instance, the minute structure, or divined the many functions of the root, stem, leaf, or flower of the commonest plant, without the microscope, or, what should we understand of the minute structure, or development, of the algæ, diatom, desmid, volvocine, or, of an innumerable number of the minute plants, but for this instrument? while a few minutes examination of the circulation in the cells of the plant, or of the blood rushing through the arteries, capillaries, or veins in the foot of the frog or the tail of the tadpole, teach us far more than hours devoted to books alone.

Again, with the higher powers of the microscope and the aid

of aniline dyes, we are able to examine and follow the life history of animals or plants, entirely unknown to previous generations: by its use the medical man is better able to arrive at a right diagnosis, and hence, better able to cope with the disease he almost daily comes in contact with. Its value in the detection of adulteration, too, is very great. Whether it be silk, woollen goods, or cotton, that is under examination, the microscope speaks with no uncertain sound, while the important part it plays in the examination of foods is such, that were the microscope withdrawn, the Adulteration Act would almost become a dead letter.

Again, to the scientist, who has to assist the authorities in the detection of crime, the microscope is all powerful as an implement of research, whether he has to determine if a drop of blood, be human, or otherwise, or whether some subtle poison is the thing to be discovered and detected. To still further assist him, the scientist has called to his aid the Photographic Art, to be used in conjunction with the microscope and to illustrate how both may be applied, I cannot do better than quote portions of an article by T. C. Hepworth, which appeared in "Chambers' Journal" a short time since.

The subject of the paper is the result of work done by Dr. Paul Jeserich of Berlin.

The first criminal case brought forward, was one in which the liberty of a suspected man literally "hung upon a hair," for by a single hair was he tracked; the case was one of assault, and two men were suspected of the deed; a single hair was found upon the clothing of the victim. This hair was photomicrographed. One of the suspected men, whom we will call *A*, had a grey beard, and a hair from his chin was treated in the same manner, the difference in structure, tint, and general appearance was so marked, that the man was at once liberated. The hair of the other man *B*, was also examined, and but little resemblance was discovered to that found on the victim. The original hair was now carefully scrutinised, and compared with other specimens.

The photograph clearly showed that the hair was pointed, and that it had never been cut, gradually the conclusion was arrived at, that it belonged to a dog, an "old yellow smooth haired, and comparatively short haired dog."

Further inquiry revealed the fact that *B* owned such a dog, a fresh hair from this animal agreed in every detail with the original photograph, and the man was convicted. He subsequently confessed that he alone had committed the crime.

In the identification of blood stains, several difficulties occur, it is easy for the microscopist to tell whether the blood submitted for examination is that of a mammal, of a bird, or, of a fish, for the corpuscles of each have distinct characteristics, but when we ask him to differentiate between the blood corpuscles of the different kinds of mammals, he is somewhat at a loss, because his only guide is that of size.

Thus, the blood corpuscles of the elephant, are, as might be expected, larger than those of any of the other mammalia, but they are in other respects, like those of man, round in outline. A dog, or pig, possesses corpuscles of a smaller size ; while those of the goat, are very much smaller still.

Dr. Jeserich says : A murder had been committed, and *D.* was the man suspected, suspicion being strengthened by the circumstance, that an axe belonging to him was found smeared with blood, which had been partially wiped off. The man denied his guilt, and accounted for the blood-stained weapon, which he declared he had not taken the trouble to wipe, by saying he had that day killed a goat with it. The blood was examined microscopically and the size of the corpuscle proved his statement to be false. A photo-micrograph of it, as well as one of goat's blood was prepared, in order that the judge and jury might make a comparison. Another photo-micrograph was made from part of the blade of the axe, which showed, very clearly, by unmistakeable streaks, that the murderer had done his best to remove the traces of his crime. This last case shows the value of the instrument for the confirmation, as well as the detection, of crime.

The next section of the work, treats of the detection of falsification of hand writing and figures, by means of photography in conjunction with the microscope.

The microscope alone, will not aid much, although we can detect by it places in the paper where erasures have been made, it is also possible, by its aid, to ascertain whether an alteration has been made in a word before the ink first applied has become dry, or whether the amendment has been an after thought.

In the former case, the previously applied ink, will, more or less, amalgamate with and run into the other, as will be clearly seen under the microscope, while in the latter case, each ink mark will preserve its own unbroken outline.

Such, ladies and gentlemen, are a few of the revelations of the instrument I have endeavoured to interest you in, and in thanking you for your kind attention to-night, we hope your interest may continue and that we may all have a successful session.

WEDNESDAY, NOVEMBER 14th.

PHOTO-MICROGRAPHY

(With Illustrations by Electric Lantern),

BY

MR. T. CHARTERS-WHITE, M.R.C.S., L.D.S., &c.

As the value and interest of this paper centred so much in the admirable diagrams and slides shown by Mr. Charters-White, it is impossible to do justice to his address without a reproduction of the illustrations. Members will find the substance of it in the new edition of his well-known work, "A Manual of Elementary Microscopical Manipulation for the use of Amateurs."

WEDNESDAY, DECEMBER 14TH, 1892.

THE EVOLUTION OF THE BIRD,

BY

MR. H. M. WALLIS.

The lecturer began by assuming that the bulk of his audience were more or less Darwinians, and stating that he should treat his subject from the point of view of the evolutionist, not that Darwin had proved his thesis—the great theory was a theory still—but since the accumulated observations of the thirty odd years which had elapsed since the "Origin" was published had immensely strengthened its positions, we might perhaps accept evolution as a working hypothesis, as a master-key which undoubtedly unlocked scientific difficulties, otherwise insoluble.

He proposed to call attention to that unity of plan which we so constantly found persisting through extreme diversity of detail and confessed that the only explanation of this persistence which satisfied his own mind was Heredity.

Taking as his starting point the period when the coal was forming, and the only occupants of the dryer portions of the globe appeared to have been amphibia, attention was drawn to the remains of Archegosaurus, one of the larger and more heavily armoured species. Though not a lizard, as we now understand the term, and differing from all subsequent true lizards in the formation of the spinal column, yet this highly specialised amphibian, was in itself so unmistakably crocodilian and was connected with the true crocodiles of later epochs by so many intermediate forms in successive deposits, that it seemed likely that we had in it the link between the Amphibia and the Reptilia.

At some point of this chain of development the Archosauria (First or Early Lizards) appeared, bulky animals of the crocodile type for the most part, one branch of whose descendants continuing aquatic and varying but little became in time Crocodiles, whilst other branches changing their habitat and habits and varying much became either aerial as the Pterodactyls, marine as the Ichthyosauria or fitted for a life on dry land as were many of the Dinosauria.

Aëtosaurus and Phytosaurus of the German Trias which seemed to have been long-limbed terrestrial lizards, probably vegetarian in diet but of crocodilian appearance, in some way connected the Archosauria to the more highly specialized Scelidosaurus of secondary times. This animal recalled the Fleet Street Griffin shorn of his wings, he was almost unarmoured, the ancestral plate mail having disappeared from back and breast but lingering in a series of lateral scutes suggestive of the ports of a man-o'-war. The most noticeable change was the mode of progression, this branch of the great lizard stock was biped, the fore limbs small and unimportant, the hind limbs long and powerful forming with the tail a tripod upon which the pelvis (now becoming important and bird-like in form) and the lower spine (now found auchylosed into a stiff rod as in birds) were upheld in an almost erect position. This animal probably browsed upon the foliage of low trees. Another change had taken place, the functional toes of the hind foot were reduced to four and in the next form to which the lecturer called attention, the Iguanodon of the Wealden Deposits, these digits were but three and the form of the foot had become unmistakably avian,

had assumed in fact its final form from which it hardly departed in the least particular in descendants as remote, and in other respects as diverse, as the modern Emu. The lecturer illustrated this point with sketches of the bones of the foot of Iguanodon and of a natural cast of the foot itself found near Hastings.

Other points of structure in which the Ornithopoda, or Bird-footed division of the Dinosauria, seemed to fore-tell the coming race of Birds, were the cellular structure of their bone and the horny processes (beaks) with which both upper and lower jaws of the Iguanodons terminated.

At this point the Pterodactyls were referred to, true flying reptiles who flourished in Secondary times, and which seemed in some cases to have acquired several bird-like characters such as (in some species) toothless beaks, cellular bones, and a keeled sternum upon a totally independent line of evolution. They flew by a patagium or extension of skin or membrane stretching from the sides of the body (sometimes from the lower limbs even) to the outer edge of an enormously developed little finger, but there was no reason to suspect them of feathers, and although some of their remains are exceedingly bird-like at first sight, it seems probable that the birds descended through the giant terrestrial dinosauria, using their acquired pelvic arrangements first for land progression then for swimming. It was probably during an amphibious interval in the evolution of the bird, that the fingers of the fore limb became webbed and the down upon the loose skin (patagium) of the back of the arm developed into something approaching the swimming paddles of the auk and penguin. From such an arrangement used first under water (as diving birds still used their wings), then along the surface as the steamer-duck and many species still used them, the steps to partial and then to perfect flight were at least thinkable.

These steps, however, were matters of conjecture. From various causes bird fossils were among the very rarest of all animal remains. A bird in nature usually escapes just those accidents, bogging, engulfing, &c., to which we owe the preservation of mammalian and reptilian remains. It was well seen to be no part of the scheme of nature to preserve a complete record. We knew hundreds of species by their teeth alone, yet birds, speaking broadly had no teeth; no one had been bold enough to describe as avian any detached teeth from secondary or earlier deposits. Birds' bones were usually small and always more fragile than those of other animals, hence the particular family of reptiles which varied in the direction of bird-like lightness and

fragility and acquired bird-like powers of escape left the fewest remains.

The connecting or intermediate forms between the Dinosauria and the true birds were very few. One, the most interesting and important, the Archæoptery of the Solenhofen fresh-water limestone was a feathered flying reptile with sclerotic rings to its eyes, un-anchylosed pelvic arch, three clawed digits on each fore limb, one of which at least was free and functional although the other two seem to have been enveloped in a stiff patagium and supported a system of primary and secondary quills of the usual flying-bird type. It unquestionably had a horny beak and teeth of the usual simply conical reptilian pattern. Its tail was transitional, each of its sixteen joints carrying a pair of true feathers of which it was difficult to see the use in such a position.

Although the first Bird to our knowledge it was evidently the descendant of a long series of highly specialised forms of which at present we know nothing. For instance, the feathers of the existing Apteryx were of a more archaic type than those of this fossil from the Jurassic. We had much left to learn.

Between the Archæorpteryx and the fairly numerous bird remains of early Tertiary deposits, most of which can be assigned to existing families and even genera, stand Professor Marsh's discoveries in the Kansas Chalk, Hesperornis a Struthious, or Ostrich-like swimming bird with degraded wings, reptilian, tail, and keel-less breast-bone, and the small and graceful Ichthyornis of gull-like outline, bearing wings of the modern and familiar type associated with a deeply-keeled sternum and fan-shaped tail. Both species had teeth, and the latter's cervical vertebræ were bi-concave and fish-like in type, the last occurrence in the pedigree of the bird of a structural peculiarity of immense antiquity and since superseded, even amongst most reptiles.

The lecturer then addressed himself to the skeletal framework of the bird, and with the assistance of specimens and diagrams pointed out homologous structures in the preceding saurians and amphibians, traced the beginnings and history of the Pelvis, the first indications of the sternum superseding the at one-time all-important Coracoid bones in the circuit of the pectoral girdle.

The steps by which the normal reptilian leg with tibia, fibula and five toes was reduced to the leg of the modern bird were pursued in considerable detail in a series of diagrams, in which homologous structures superficially most unlike were connected,

and their relationship insisted upon. Lastly the history of the wing was dealt with in a similar fashion, the clawed thumbs of the adult ostrich and embryo duck, the clawed digits of the nestling Hoatzin, &c., were shewn in diagram, and their importance as evidence of reptilian ancestry suggested. The anchylosed finger-bones were taken as evidential of flight and that even the ostrich is descended from forms which enjoyed aerial, or at least an aquatic form of flight for a longer or shorter period, as is shewn by the persistence beneath his plumes not of any form of degraded foot or paw, but of a true wing, albeit its lizard ancestry is denoted by a claw.

WEDNESDAY, JANUARY 11th, 1893.

AN EVENING FOR SPECIMENS, &c.

Amongst the objects exhibited the most interesting was "A tooth impregnated with Phosphate of Iron," by Mr. Charles Dawson, F.G.S., who has kindly contributed the following *Notes* on it.

The tooth is apparently one of the lower incisors of a calf (deciduous) (Bos).—As the incisors of Bos vary only slightly, it would be difficult to determine if the tooth may belong to one of an extinct species. The specimen was obtained by me from a Brighton jeweller, who could not discover its history, as it had been bought promiscuously in a lot of precious stones from a dealer, and was thought to be turquoise.

It was examined by the Keeper of the Mineralological Department at the British Museum, who on superficial examination thought it was artificially coloured by a copper salt. Upon analysis, however, no traces of copper were discovered, and there were *iron* reactions.

The front surface of the tooth has been artificially polished, ready for cutting by the trade as a turquoise. The colour is said to be that of a fine Persian turquoise, and is probably more permanent, the colour of the turquoise proper being notoriously

susceptible of deterioration by action of light and exposure. It may be stated that for many years very few of the real Persian turquoises have found their way to Europe; the quarries having been closed except for Royal use in Persia. The majority of "stones" at present in use in Europe being artifical vitreous productions, and others cut from a substance known as Odontolite. Odontolite is a mineral formed from animal remains decaying in contact with sulphate of iron (iron Pyrites) under certain conditions. The sulphate of iron combines with the phosphate of lime, in the teeth or bones of the animal, forming *phosphate of iron* or vivianite. Where this process takes place in bones, the surface of the bone being naturally dull, the colour is a dull blue, but seen through the enamel of a tooth the colour is of a turquoise blue colour.

I have attempted to imitate this process as follows:—Distilled water is thoroughly boiled so as to get rid of as much air as possible, and sulphate of iron dissolved in it, a clean deciduous incisor tooth of a calf is then placed in a bottle and the solution poured on. The whole is then well stoppered. In a few hours the colour of the tooth commences to change to a slightly greenish colour. Owing to animal matter detached from the tooth, causing the solution to appear milky, the solution is then changed, and this operation may be repeated as often as the solution is discoloured. In a few days spots and patches of a colour exactly resembling the turquoise colour of the specimen in question, begin to form in the pulp cavity of tooth below the enamel, and the portion so marked appears bright and clear through the surface of the enamel. So far I have been unable to obtain a specimen coloured so perfectly and evenly as the specimens produced. On each occasion some portion has changed to a rusty brown, owing I suppose, to air having been introduced into the solution. Unfortunately the iron sulphate cannot be dissolved in spirit.

The *deciduous* incisor of a calf is a particularly good subject for the experiment, as the front surface of the tooth is broad and regular, and susceptable of a high polish. The pulp cavity is also large and there is a greater presence of phosphate of lime.

The Egyptians were acquainted with the art of dying teeth and bones with a solution of sulphate of copper, but the colour had a greenish hue, not so pleasing as that of the tooth of the calf produced.

Copper was also probably used in staining the ivory handles of the knives and forks in use at the end of the last century.

This process of staining is now said to be "lost" to the trade, and the old specimens are highly prized. I take it that the same might be easily effected with an analine dye.

Specimens of *odontolite* are not very rare to the trade, but the colour is usually of a deeper blue than is proper in a turquoise, and more resembling vivianite or phosphate of iron proper.

One of the largest known pieces of vivianite (the scapula of Bos) was given by me to the Museum of the Royal School of Mines, Jermyn Street, London, and was found on the Castle Hill, Hastings, in excavating. Perhaps, if exposure to sulphate of iron was carried to excess the deeper colour of vivianite might be obtained in the experiment above mentioned.

On the whole the genuineness of the turquoise colour of this particular tooth must be considered doubtful as a natural product, though there is every reason to suppose that the colour may occur naturally in other specimens.

WEDNESDAY, FEBRUARY 8TH, 1893.

On invitation of the Council, the Photographic Section exhibited to the members generally, by the Electric Lantern, the Slides which had competed for prizes during the year.

WEDNESDAY, MARCH 8TH.

PERFUMES—THEIR SOURCES AND MODES OF PRODUCTION.

BY

MR. J. CHARLES SAWER,

(*Author of "Odorographia," &c.*)

The constantly increasing importance of this industry may be best explained by describing a few of the principal materials, or raw products, and the methods of producing them.

Selecting first the Rose, as the plant with which we are most familiar :—

The otto is made in Bulgaria, in France, in Germany, and in India. The most important rose plantations are situate south of the Balkan mountains, and extend from 24° 30′ E to 26° 8′ E longitude, on the fertile lands east and west of the town of Kezanlik. The annual production 50 years ago was from 440lbs. to 660lbs. The average production of the four years 1889-90-91-92 was 4,316lbs., distilled from an average of 4,695 tons of flowers. The merchants themselves distil but little; the otto is brought to them by their agents who travel from village to village and buy it up from the peasants who distil it. The number of stills employed is recorded as 7,290.

The species of Rose cultivated in Bulgaria has been clearly identified as the *Rosa Damascena*, the "Damask Rose," a native of Syria. A microscopic examination of the transverse section of a rose petal, reveals that the otto is secreted in cells on both its surfaces, those of the upper epidermis being of a papillary form, and those of the lower, of an elongated cubic form.

The rose harvest commences about the third week in May, and lasts about a month. There is sometimes another small gathering of flowers in November.

The distillatory apparatus employed by the Bulgarian peasants is a very crude and original construction and the opera-

tion is conducted in a very careless way, the result being that the delicate fragrance of this beautiful flower is to a great extent destroyed, but apart from this consideration, the otto so produced is a very untrustworthy product by reason of the wholesale way in which it is adulterated, both in Bulgaria and in Turkey.

Recently, efforts have been made to produce this oil from roses grown in Germany, and it is probable that by collecting the flowers with care, rejecting all the green parts (which contain a resinous matter of very deleterious odour) and distilling the petals alone, whilst *quite fresh*, in stills of more rational construction, that a product will be obtained which will compete with the Bulgarian otto. The amount of land under cultivation in Germany is about 180 acres, and, although the trees are still young, the harvest of 1892 amounted to 142 tons of blossom; sometimes as much as 23 tons being gathered and worked up in one day. In the midst of these German plantations, a factory is now erected and fitted up for the manipulation of 1,000 tons of roses in three weeks; rapidity of working being an element of success, otherwise the flower suffers loss by evaporation and injury by fermentation.

The Rose is also largely cultivated in the South of France, especially in the neighbourhood of Grasse. One manufacturer informed me that his crop of 1892 amounted to 1,760 tons of flowers. The species of Rose here cultivated is the *Rosa centifolia*. The bushes are set in rows, but not so close together as to form compact hedges, as in Bulgaria, nor do the plants attain such a height. The flowering time begins about mid-April and lasts through May to early June. In the province of the Alpes Maritimes there are sometimes gathered as many as 150 tons of roses in one day. At the factories the petals are first completely separated from the green parts, and the separated petals, of which there are sometimes as much as four tons accumulated on the floor at one time in one factory, are then either distilled with water for the production of rose-water, or they are macerated in warm purified grease, or subjected to the process of absorption by cold grease, for the purpose of afterwards obtaining the extract therefrom by washing the grease with strong spirit of wine. The French otto of rose is generally collected as a by-product in the distillation of "Rose-water." It has a greater consistence than the Bulgarian otto, is more green in colour, and is not subject to such extensive adulteration. At Grasse 1lb. of otto is collected from 8,000 to 10,000lbs. of rose-petals.

It is evident that the principal difficulty which both the

Bulgarian and the French manufacturers have to cope with, is that of manipulating great bulks of flowers whilst in the fresh state, the period of floration being so very short in comparison with the vast crops. It is therefore fortunate for the French manufacturers that all the different sorts of plants they grow do not blossom at the same time of the year. Thus,the earliest flowers appearing are those of the *Violet.* The variety of violet giving the best result is that known as the "Double Parma." Its perfume is extracted by the process of absorption, as also the following floral perfumes, and in the following order :—

In March, the *Jonquil,* a bulbous plant of Oriental origin. Its blossoms appear four or five on each stem, and each is picked off as it appears. This harvest is of very short duration.

The flowers of the Mignonette are taken in April, according to the warmth of the season. It is a native of Egypt and the coast of Barbary.

From the middle of April until the end of May or the early part of June, the time of all hands is very much occupied with the orange-flower harvest, both flowers appearing at about the same time, and both being treated in the same way. The orange-flower yielding by distillation the beautiful product known as "Neroli," also the much-esteemed orange-flower water. Extract of orange-flower is also made by the absorption process and is very superior in odour to the distilled oil and water.

The next crop gathered is the Jasmin. These flowers are produced from July till the middle of October ; those of August and September being the richest. The perfume is extracted by the cold process of absorption, but in Tunis and in Algeria there are species of jasmin so strongly odoriferous as to yield an essential oil by distillation.

Another late flowering plant of great commercial importance in the South of France is the *tubéreuse.* It there grows in the open air, and attains greater perfection that when grown in England under glass. This harvest commences about the first week in July and lasts till the middle of October.

The last of the floral odours collected in France is the Cassie, the flower of a species of Acaica, native of the West Indies, and originally naturalised in Europe in the Farnesian Gardens at Rome, hence its name, *Acacia Farnesiana.* As grown in the districts of Grasse and Cannes the Acacia forms a tree of fifteen feet in height, and flowers from October to February. The perfume is extracted by the absorption process. Another Acacia, native of Australia,is known as the " Silver Wattle." Its flowers

are used in the same way, and sometimes submitted to a process known as "solution," *i.e.* a powerful solvent such as chloroform, ether, petroleum ether, or methylchloride is poured over the flowers, and after a few minutes strained off; the solvent is then evaporated at a very low temperature in a vacuum still and the essence (known as concrete essence) isolated.

Thus by the processes of maceration, absorption, and solution, may be obtained the delicate perfumes of flowers which would be destroyed by the coarser process of ordinary distillation with boiling water or steam; amongst such flowers are the Gardenia, Ximenia, Pergularia, Stephanotis, Xylopia, Magnolia, and hundreds of others too numerous here to name; yet some tropical flowers contain volatiles in sufficieut quantity and power to permit of the process of distillation being employed, such as the Zambak (Jasminum Sambac) of Arabia and India, the Ylang-Ylang (Cananga Odorata) and the Tjempaka (Michelia Champaca) of southern Asia and the Philippine Islands. Such flowers as these and those of the Pandanus (screw pine) are much valued in the east on account of their powerful fragrance, the Oriental taste inclining to perfumes which are not only strong, but even rank, such as Patchouli, Santal and Musk. The first-named is a plant very much resembling a Coleus, both in appearance and habit of growth. It is a native of China, but has been introduced and cultivated in many parts of the Tropics. Its dried leaves now form an article of commerce in which an immense business is done. The leaves and the essential oil are in much request in India and Arabia; the leaves are also shipped to London, packed in bales of about 2cwt. each and sold on the Drug Market. This oil is probably the most powerful of all the essential oils; it is distilled at Penang and Singapore also very largely in Germany and France.

The Santal is the produce of several species of the genus *Santalum*. The East Indian santal wood is derived from *S. Album*, native of the mountainous parts of India, thriving up to elevations of 4,000 feet, and yielding the largest quantity of oil when grown on dry, rocky soils, or soils of volcanic origin. The wood is all sold by weight, at the annual Government auctions, native merchants congregating from all parts of India to make purchases. The Mysore Government also have establishments for distilling the oil, and this is sold at the annual auctions along with the wood, being chiefly bought up for exportation to China and Arabia. About 12,000lbs. weight of this "Indian oil" are annually imported into Bombay from the Malabar Coast, but

only about 1,500lbs. of it are sent to England, and that is adulterated. The best santal oil supplying the European and English markets is distilled in Germany and in London.

The bulk of the oil of *Cedar* of commerce is economically produced by distilling the saw-dust and waste wood of the lead pencil factories. In some factories in Germany this refuse accumulates to such an extent that it is sold at a very low price to get rid of it,as it would otherwise be used only as fuel. This wood is called "red cedar" or pencil cedar," and is yielded by a Virginian Juniper, native of the greater part of the United States. It is quite distinct species from the West Indian Cedars from which cigar boxes are made and from the well-known Cedar of Lebanon.

Other trees supplying products of immense commercial value are known collectively as the *Citrus* tribe, and yield the "Citrine" odours; such are the Lemon, Orange, Citron, Lime, and Bergamot; there being many varieties of each species flourishing in most tropical and sub-tropical countries,but the industry in the essential oils derived from them is principally centered in Italy, especially in the districts of Palermo, Messina and Genoa in the northern part of that country and in Calabria in the southern part.

All members of the orange tribe yield distinct products from the flower, the leaf and the fruit. The Bergamot orange is the fruit of the Citrus Bergamia, much cultivated at Reggio and the adjacent villages on low-lying lands near the sea. The oil is extracted from the fully developed but unripe fruit, gathered in the months of November and December whilst still more or less green.

Of the few perfumes derived from the animal kingdom, the most important is Musk. This substance is secreted in a part of the body of a small deer inhabiting the Atlas and Himalayan mountains at elevations between 8,000 and 14,000 feet. This secretion is obtained only from the male animal. When fresh, it is in the state of a soft, salve-like, reddish-brown mass; by keeping, it dries, becomes blackish-brown, and assumes the form of little rounded grains. It is extensively adulterated by the Chinese, who are great adepts in the art of adulteration. The principal adulterants are dried blood, earth, and very small pieces of lead.

Another substance somewhat analogous to musk is Civet. This is secreted by two animals of the genus Viverra (V. zibetha and V. civetta), one a native of Asia, the other of Africa.

Nearly akin to musk in perfume, is the costly substance known as Ambergris. This is a biliary concretion of the

Spermaceti Whale, and is generally considered to be a product of disease. It is found floating on the sea near the coasts of various tropical countries, sometimes even as far north as the coast of Ireland, and sometimes in the whale fisheries of the southern hemisphere. It varies greatly in quality and value.

Space will not allow of even a brief description of the many other materials derived from nature or of the very interesting products now artificially produced for use in this business.

WEDNESDAY, APRIL 19TH, 1893.

THE ORIGIN AND DISTRIBUTION OF COAL,

BY

PROF. T. RUPERT JONES, F.R.S., F.G.S., &c.

In illustration of his Lecture Prof. Jones exhibited a large number of diagrams, maps, &c., the latter showing the localities of the known and probable coal-measures; the former, representations of the plants out of which coal was formed; such as Lepidodendron, Sigmaria, and Calamites, some of them lent by the celebrated authority on the subject, Mr. Carruthers, copies of which have been incorporated into almost every text-book of Geology.

Prof. Jones in calling attention to the various diagrams and pictures round the room, drew the attention of his audience to the representation of the cones of various trees which even down to their pores were traceable in coal; also to those of shells of the common pupa and other organisms, and of a creature allied to the centipede, which were found in coal in enormous quantities, showing that similar forms of life existed during the carboniferous period as were found amongst us now. He also dwelt upon a diagram of a deposit which had not passed into the ultimate condition of coal, and in which the wooden structure of different trees and tree ferns, together with their spores, were clearly distinguishable in the process of conversion. Speaking upon the varieties of coal, Professor Jones said that

what was sometimes called the best coal was anthracite. The diamond was the only pure form of carbon, but anthracite contained as much as ninety per cent. of carbon. It was interesting to know that any of the other kinds of coal might pass into anthracite by a natural process. That process seemed to be connected with heat, not the direct burning heat, but that of the pressure of other strata, whether lateral or otherwise. Under such conditions coal became anthracitic, and where distillation had gone on, petroleum was produced. One of the valuable qualities about anthracitic coal was that it gave off no smoke during combustion, owing to its being devoid of a hydro-carbon. It also produced greater heat, and hence its use in the Navy and for the production of steam. Other kinds of coal were often sold as smokeless coal; these were not really anthracitic coal but mud coal, which had very little heat-producing qualities, and left an enormous quantity of ash. After briefly touching upon the character of other coals, in the course of which he alluded to the gaseous characteristics of cannel coal, Professor Jones went on to speak upon the formation of the coal deposits. The period of coal formation, he said, was in all probability a very luxuriant age, the areas being covered with jungles, interwoven with a dense undergrowth. From time to time square miles of these jungles would be swept down by a tornado, or by other causes and in course of time the fallen masses of vegetation would be inundated,either by storm or by the rising and falling of the land There, under the water, the trees decomposed and changed into that black shiny substance now to be found in the peat bogs in Ireland. Chemical changes went on, until what was wood became coal. Sometimes, however, the branches and parts of the trunks of the trees remained up out of the water, whereupon they did not undergo the chemical changes of the submerged parts, but rotted away down to the level of the water, and became mere rotten touchwood. and in some cases the markings of these trees could be seen in the shales that came from the neighbouring beds. As an indisputable proof of the fact that coal was formed of trees in this way, Professor Jones mentioned instances in which the wood had become calcified before it had turned into coal, and in such instances the structure of the trees and ferns was clearly traceable. In Scotland a volcanic eruption had come down on a coal field in the course of formation, and, very much after the style of what happened at Pompeii, the lava sealed up the materials of which the coal was being formed, and arrested further progress, so that microscopists of the present day could

discern the structure of the rotting woods. One of the beds of cannel coal in Yorkshire contained nothing but the spores and vesicles (sporangia) that had escaped from the cones of the trees, the bed thus presenting an amazing problem as to how the spores came to be deposited in such countless myriads. No wonder that such coal was used for the manufacture of gas, for the spores of such cones (lycopodium) were so bituminous that they flashed when thrown across a burning candle, and they had thus been used for the production of stage lightning. Fire clay, from which encaustic tiles were obtained, was formed from the mud that underlay the coal seams, being the mud upon which the plants lived prior to their being formed into coal.

Commenting upon the abundance of life that existed during the period of coal formation, Professor Jones said that, amongst others, there had been found some 30 species of reptiles, 150 species of fish, and between 30 and 40 species of insects, as well as crustaceans, of which there were some representatives at the present day. Turning to the coal distribution, Professor Jones said that coal fields extended from the West of England through Belgium, to Westphalia, Germany, and on into the upper parts of Scandinavia, coming back through Yorkshire, Cumberland, round by the borders of Wales, and across into Ireland. It had been suggested some time ago by Mr Godwin-Austen that in Palæozoic times coal jungles existed on the northern side of a ridge extending from Somerset on through Kent, and that coal could probably be found along that line. This theory had in part been verified by the discovery of coal at Dover, a seam four feet in thickness being found at a depth of 1,930 feet. The discovery was a very important one as confirming Mr. Godwin-Austen's view, although the exact localities of the coal beds and the directions in which they extended could only be determined by borings. In conclusion, Professor Jones said that as the sunshine caused the growth of leaves and wood, so the fossil wood represented so much sunshine, or force of light and heat, and these were again evolved in the burning of coal and gas. Thus in coal was stored up a force that saved the wear and tear of human muscle and sinew, and did away with the fearful toil which makes simple slaves of men, and enabled them to gain their daily bread by easier means. The great earth disturbances that had brought up the strata in which coal was stowed away, and enabled man to work the coal they contained, certainly must at times have included earthquakes, once thought to be evidences of God's anger, but really systematic agencies bring-

ing valuable treasures within man's reach, and which would otherwise have been lost to the world. Thus, instead of misfortunes and deprivations, they had been among the greatest blessings we enjoyed. Hurriedly as he had gone through the subject, he had tried to point out some of the relationships of coal and its origin, and how its present condition had been brought about. These ancient forests received their light and life from the sun, and therein was the poetry of the subject; the same sun which gave light and heat in those far-off days was the same sun which gave life and heat now, and from those distant ages the sun's ligh tand heat had been carried down to us wrapped up as it were in the fossil plant-beds, in such a form as to be of the greatest value. Further, the movements of the earth's crust, doubtless accompanied by earthquakes and convulsions, had so broken and shifted the strata that some of them, which would otherwise have remained buried miles deep, had been bent, dislocated, and turned edge upwards, so that now this fossil fuel, so indispensable for modern civilisation, had been brought, at many places, within the easy reach of man. All this had doubtlessly been planned and carried out by the wise ordination and all-seeing providence of the Creator, by whose perfect laws every atom of the earth as well as every organic particle had taken its right place in this created world.

WEDNESDAY MAY 10TH.

STONE IMPLEMENTS,

BY

MR. ARTHUR GRIFFITH, M.A.

Mr. A. F. Griffith exhibited examples of stone implements and drew attention to the fact that one large group, the Palæoliths, have been found in various parts of the world and usually, if not always, in deposits which from the situation and the fossils they contain are considered to be of very high antiquity.

The other large group, called neoliths or surface implements, are found almost all over the world, in some remote parts of which they have been used down to historic times.

He showed that while the neoliths vary in form to an extraordinary extent, having evidently been used for an immense number of different purposes (exhibiting out of the museum collections, examples of chisels, knives, saws, hammers, scrapers, arrowheads, daggers, &c.) the palæoliths on the other hand, from whatever part of the world, were referable to one or other of two types, the object in view in the manufacture of which no one had yet satisfactorily accounted for. This similarity of forms from different parts of the world would have been more easily explained had these forms been obviously suited to some obvious want of the human race.

He shewed also that in other ways the neolithic men excelled in skill their palæolithic predecessors who never added to the hammer-chipping on their implements the fine work which distinguishes the neoliths and which was apparently executed with the help of a point of wood or bone. Nor did the earlier race ever polish the whole or any part of an implement.

While most of the implements exhibited were of flint, basalt, or some other kind of hard stone, some from Barbados were of the hard inner column or outer lip of the Conch-Shell (Triton), and it was explained that this peculiarity was a consequence of the absence of any suitable stone from this and a few other coral islands; though the presence among the shell implements of other implements made of stone showed that by barter or otherwise the islanders were able to obtain supplies from other countries.

Among the rarer exhibits were palæoliths from South Africa, including one found in the high level gravel behind Port Elizabeth. Also the two implements of palæolithic form from the neighbourhood of Richmond, Virginia, U.S.A., which are among the very few authentic implements of that form which have been met with in the New World, though authorities still differ on the question whether such implements there are more ancient than the surface implements which are met with in such quantities in many parts of the States, Canada, and other parts of the continent.

WEDNESDAY, JUNE 14TH, 1893.

At the close of the Annual General Meeting an Ordinary Meeting was held, at which a Paper was read entitled

DISCOVERY OF THE REMAINS OF GYPS FULVUS IN A VOLCANIC DEPOSIT NEAR ROME,

BY

DR. E. J. MILES (of Rome).

About 20 miles from Rome rise the Alban Hills, surmounted by Monte Covo, 3,127 feet above the sea. At the beginning of the Pleistocene period the site of these hills and the whole of the Roman Campagna was covered by the sea to the foot of the Apennines. Then, according to some geologists, began that series of submarine volcanic disturbances which resulted in the formation of a layer of tufa on the pleistocene sea-bed accompanied by a slow upheaval. After an interval, during which the dry land portion became occupied by animal and vegetable life, another volcanic eruption, aerial in character, took place, whereby a second layer of tufa was formed on the top of the other. The first layer is hard and compact, the upper one "tufo granulare" much softer. From the surface of this so-formed undulating plain arose the volcanic group of the Alban Hills. The lakes Albano and Nemi occupy the craters of two of the larger of these old volcanoes. Of the rocks evolved in these eruptions two kinds may be specially noticed, a leucitic lava, and a peperino. A mass of the former rolled across the Roman Campagna to within three miles of the City, and from earliest times has been much used for paving stones, &c. Peperino is a greenish grey fragmental rock, with interspersed crystals of Augite, Leucite, Biotite, Magnetite, &c. According to Panzi it was largely formed out of a volcanic ash by the aid of torrents of water.

Impressions of grasses, &c., are found in its beds, which shows that its temperature was not high. A few months ago in

breaking open a large mass of Peperino found near Frascati, a natural cavity was discovered within it, in which were several bones in the form of a skeleton. Impressions of feathers, &c., were seen on the walls of the cavity. One of these showed the head and neck of a bird devoid of feathers except mere downy traces of them. Another presented the interior of the mouth and tongue with the cavities at the back of the nostrils. The impressions of true feathers looked as if the bird had struggled much before dying. The imprint of claws, &c., proved that the bird was of the vulture tribe, and Signor Meli has been able to determine the species as that of "Gyps fulvus." It may appear strange that a bird so strong of wing should have been buried in this manner. The bird which is now rare in Central Italy is not uncommon in Sardinia, and the shepherds are able to kill them easily after they have well feasted on carrion, which they gorge until they can only rise from the earth with great difficulty.

It is probable that this bird, while in such a state of repletion, was overcome by the poisonous vapours which so often accompany volcanic eruptions, and being suffocated, found a grave in the then semi-fluid mass of peperino, whence it was subsequently brought to light in the manner described by the contadini of the Alban Hills.

WEDNESDAY, JUNE 14TH.

Annual General Meeting.

REPORT OF THE COUNCIL

FOR THE YEAR ENDING JUNE 14TH, 1893.

The Council has much pleasure in bringing before the notice of the Society the record of the work done and the progress made during the past Session. The valuable papers read at the Ordinary Meetings of the Society have been of more than usual excellence, and the Council only regrets that the audience assembled to listen to them has not been always in proportion to their merits.

The interest manifested last year in the work of the Photographic Section, then first established, has been well maintained, and the members have commenced a photographic survey of the County in which objects of interest both from an archœological and geological point of view are included. The views thus taken will form an interesting record and will become the property of the Society.

The Council regrets, however, to record the retirement of Mr. Walter Harrison from the Secretaryship of the Section in the successful formation of which he has borne so large a part. The President of the Society, notwithstanding the many calls on his time and attention inseparable from his office, has continued the admirable series of demonstrations to the members of the Microscopical Section alluded to in our last Report. The Botanical Section has during the last official year been fully organized. Many of its meetings and excursions have been well attended, and it has taken on itself the onerous work of a Botanical survey of the country within twelve miles of Brighton. The Town Council having generously placed at the disposal of

the Society a piece of ground in Preston Park for the purpose of growing rare and interesting plants, the Section has undertaken the care of it. In connection with the numerous meetings during the Session (now between 30 and 40 instead of eight or ten as formerly) which are held in this room, in which by the permission of the Town Council we are privileged to meet, the Council begs to acknowledge the courtesy of Mr. F. W. Madden, Librarian of the Free Library, who is always ready to facilitate the arrangements which these meetings entail.

Your Council regrets that for the first time for thirty-eight years the Annual Excursion will not take place. These excursions have for some years past been a serious charge on the funds of the Society on account of the small number of members who take part in them, and as in response to a circular lately issued inviting members to take tickets beforehand to permit of arrangements being made, only comparatively few responded, the Council did not feel justified in proceeding with the Excursion, and it has consequently been abandoned. Among those members whose deaths the Council has this year to deplore that of Mr. E. P. Smith calls for special remark. He was one of the most accomplished botanists in the County, and in former years took an active part in the work of the Society.

Since our last Annual Meeting the Society has lost six members by death, and seventeen by resignation, &c. On the other hand twenty-one ordinary members, one Honorary, and two Associates have been elected.

The Papers read before the Society have been as follows :—

Oct. 12th, 1892.	Inaugural Address : Mr. D. E. Caush.
Nov. 14th, ,,	" Photo-Micrography," with illustrations by Electric Lantern : Mr. T. Charters White.
Dec. 14th, ,,	" The Evolution of Birds " : Mr. H. M. Wallis.
Jan. 11th, 1893.	An evening for Specimens.
Feb. 8th, ,,	An Exhibition of Lantern Slides by Photographic Section.
Mar. 8th, ,,	" Perfumes, their Sources and Modes of Production " : Mr. J. Charles Sawer.
April 19th, ,,	" The Origin and Distribution of Coal " : Prof. T. Rupert Jones, F.R.S.
May 10th, ,,	" Stone Implements " : Mr. Arthur Griffith.
June 14th, ,,	" Finding of Gyps Fulvus, in Volcanic Deposit, near Rome " : Dr. Miles.

The Annual Excursion took place on July 17th, 1892, and was to East Grinstead, Brambletye, and Buckhurst Park.

The Field Excursions have been as follows :—

1892.	June 11th.	West Hoathly and Ardingly.
,,	July 9th.	Buxted and Uckfield.
,,	Aug. 13th.	Worthing and Steyning.
,,	Sept. 10th.	Dyke and Bramber.
,,	Oct. 8th.	Haywards Heath and Cuckfield.
1893.	May 13th.	Three Bridges and Balcombe.

LIBRARIAN'S REPORT.

During the past year the number of borrowers has again increased, and has reached 209. It is, however, only a comparatively small number of the members who avail themselves of the advantages which our valuable Library offers to the student of Natural History and Philosophy.

The principal accessions to the Library during the past year consist of vols. 24-28 of the Reports of the Challenger Expedition, of which the Society now possesses a nearly complete series, to which two entire cases have been reserved. The beautiful new edition of Quain's "Anatomy" is now nearly finished.

The closing of the Library for one week has been found highly advantageous. The lower tier of cases has been considerably strengthened by the insertion of bearing supports.

H. DAVEY, Jun.,
Honorary Librarian.

PHOTOGRAPHIC SECTION.

REPORT.

Chairman:

Mr. J. P. Slingsby Roberts.

Committee:

Messrs. D. E. Caush, W. Harrison, C. Job, W. W. Mitchell, H. V. Shaw, C. B. Stoner, A. H. Webling.

Secretary:

Mr. G. Foxall, "Woodlands," Port Hall Road.

This section has experienced a successful session, the monthly meetings being on the whole well attended, the various medals and certificates for work mostly resulted in good competitions, and considerable interest has been manifested in the work and meetings of the section by those members of the Society who are not photographers.

The meetings held were as follows :—

Oct. 7th, 1892.	Inaugural Address by the Chairman, Mr. J. P. Slingsby Roberts, embodying suggestions for a county survey. This was cordially responded to by the Members, and steps at once taken to organize the survey. At this meeting also a paper was read by Mr. E. J. Bedford "On perspective as applied to photography."
Nov. 4th, ,,	Lantern Exhibition.
Dec. 2nd, ,,	Enlarging demonstration by the Chairman, Mr. J. P. Slingsby Roberts and Mr. J. Hunter Graham.
Jan. 6th, 1893.	Paper "On Stereoscopic Photography" by Mr. A. H. Webling.
Feb. 3rd, ,,	Paper by Mr. G. de Paris "On the place of Photography in Art."
Mar. 3rd, ,,	Lantern Exhibition, followed by a demonstration of the Platinum Printing process by Mr. Buchanan Wollaston.

Several excursions have taken place, but they were not so well attended as expected.

Some progress has been made with the County survey, a notice being issued requesting members to send in lists of negatives already made and available to form a nucleus of the collection. Brighton has also been divided into districts and allotted to various members, resulting in the production of negatives of many subjects of interest during the session.

The Committee earnestly hope that such members of the Society as are able and willing to assist in the work of the survey will communicate with the Hon. Secretary of the Section, for much remains to be done even in our town of Brighton, and still more throughout the county.

GEO. FOXALL,
Secretary.

MICROSCOPIC SECTION.

REPORT.

Chairman:

Mr. E. J. Petitfourt, B.A., F.C.P.

Committee:

Mr. J. Lewis, Mr. D. E. Caush, Mr. C. A. Wells.

Secretary:

Mr. W. W. Mitchell, 66, Preston Road.

During the Session the President of the Society (Mr. D. E. Caush), has given an instructive series of demonstrations on the preparation, staining and mounting of vegetable sections, the subject being carried to a more advanced stage than in the previous Session. A sustained interest in these practical expositions has been manifested by the members.

At the last meeting Mr. E. J. Petitfourt and Mr. W. W. Mitchell were respectively re-elected Chairman and Secretary, and Mr. D. E. Caush and Mr. J. Lewis were elected to serve as

Committee. It is hoped that the varied series of special subjects proposed for the ensuing Session will conduce to a still more numerous attendance.

1892.	Oct. 26th.	Dry mounting.
,,	Nov. 23rd.	Preparation of cuticle and mounting in fluid.
,,	Dec. 21st.	Mounting vegetable specimens in balsam.
1893.	Jan. 19th.	An evening for the exhibition of specimens.
,,	Feb. 23rd.	Cutting vegetable sections in the freezing and Cathcart microtome.
,,	Mar. 23rd.	Cutting sections by embedding.
,,	April 27th.	Bleaching, cleaning, and staining vegetable sections.
,,	May 25th.	Methods of detecting starch-grains in cells.

W. W. MITCHELL,
Secretary.

BOTANICAL SECTION.

Chairman :

DR. TREUTLER.

Committee :

MR. T. LEWIS, MR. T. HILTON, MR. B. LOMAX.

Secretary :

MR. H. EDMONDS, B.Sc., "Mount Caburn," Ditchling Road.

REPORT.

This Section was organised in January last with the object of increasing the interest in Botany, by means of papers, demonstrations, and excursions. The Section has also determined to form an herbarium of the County of Sussex. At present, however, it will confine its attention chiefly to those plants found within a radius of twelve miles of Brighton. A large number of

specimens have already been obtained by several members—notably Messrs. Hilton and Farr—which, during the coming winter, will be mounted, and will thus form the nucleus of the Society's herbarium.

The following papers have been read :—

Jan. 19th.	Introductory Address by the Chairman, Dr. Treutler, On the objects of the Society.
Feb. 23rd.	On the Collection and Preservation of Wild Flowers, by Mr. Hilton.
March 23rd.	Examination of Specimens provided by Dr. Treutler and Mr. Hilton.
April 27th.	Notes on Sussex Botany, by Mr. Jenner.
May 25th.	The Home Cultivation of Wild Plants, by Mr. Lewis.

The Saturday Afternoon Excursions have been as follows :—

May 6th.	Goring Woods.
June 3rd.	Henfield.
July 1st.	Arundel.
Aug. 5th.	Chailey.
Sept. 2nd.	Lewes, Southover and Iford.
Oct. 7th.	Isfield.

A few evening excursions have also been held.

It is to be regretted that more of the members have not availed themselves of these outings, but those who have been present have much enjoyed them and have discovered many interesting specimens.

HY. EDMONDS,
Secretary.

NOTES ON SUSSEX BOTANY.

J. H. A. JENNER, F.E.S.

Sussex affords an especially happy hunting ground for the botanist; from its Southern situation, its closeness to the sea-shore its great extent of downland, much of it in its original wild state, the great stretches of forestland in the Weald, and the abundance

and variety of water and marsh plants in the various river valleys. Out of the 1680 species of British plants given in the London Catalogue (7th Edition), the number of species which have been observed in Sussex up to the present time, may be roughly stated at 1140, of these fully 80 per cent. may, I think, be found within a radius of 10 or 12 miles of Brighton. We may note also the different Geological formations to be found in the County. There is, first the chalk with its several divisions stretching from the extreme west to Beachy Head; then to the north of this, the strata known as the Wealden, made up of various layers of clay, sandstone, and limestone. Then there are the Tertiary formations in the south-east of the County, and in a few isolated spots, some of them near Brighton. Now all these have their special floras. That of the chalk is particularly interesting. These bare Downs were once, doubtless, more covered with trees than they are at present. Westward there is still abundance of yew, holly, juniper, oak and other trees. The round-headed Rampion (*Phyteuma orbiculare*) is quite a local plant, but so common in places as to lend a tinge of blue to the turf. The bee, spider, and the frog orchis are also not uncommon. The star, thistle, *Centaurea calcitrapa,* also a local plant, is abundant in places, and in one or two very restricted localities may be found the rare *Seseli libanotis.* Beech and ash are the trees which flourish best on the Downs, and in the woods may be found many varieties of orchids. About 17 species of *Orchidaceæ* are recorded from the chalk of Sussex.

Turn we now to the Weald with its clay and sandy soils, its woods and commons. In the bog lands we note the Sundew, the Cranberry, the bog orchis and the beautiful Gentian, *Gentiana pneumonanthe.* In the woods may be found the Lily of the Valley, the Daffodil, and the Columbine. *Sibthorpia Europæa* may still be found near Waldron and Heathfield, *Genista pilosa* on Ashdown Forest, *Pyrola Media* in St. Leonards Forest; *Habenaria Albida* and *Cicendia Filiformis* may yet be discovered by the diligent botanist, and lastly we may mention the spiked Rampion *Phyteuma Spicatum,* which is found nowhere else but in Sussex.

Ferns, though scarce on the chalk, were formerly abundant in the Weald, but while some species, such as Lastrœa Oreopteris are still common in places, we may search in vain for *Hymenophyllum Tunbridgense,* formerly common, and Osmunda Regalis.

Among marsh plants, *Isnardia Palustris,* was once to be

found, but is now extinct. It may, however, re-appear in our County, as it has done in Hampshire.

Some of the old Hammer ponds in the Weald produce some rare water plants, such as *Elatine Hexandra.* In the Cuckmere Valley, the Marsh Mallow is abundant, though curiously, it has never been found in the Ouse Valley, so short a distance away.

This shows the value of the River drainage division of a district as a basis of observation.

Our seashore produces many rare and interesting species. The only locality in Britain for *Trifolium Stellatum* is Shoreham. The Sea Heath is common in places and the Samphire may still be found, but many species once common are no longer to be discovered.

The earliest mention of Sussex Plants is in the "Herball, or General Historic of Plants," by Gerarde (1636). He mentions the Sea Holly and the Spiked Rampion. Parkinson's Theatrum Botanicum (1640) mentions *Dentaria bulbifera.* John Ray (1690) notes several Sussex plants ; but the man who did most for the botany of our County was William Borrer, of Henfield, who, during the first half of the century, formed a herbarium which is now at Kew. In 1870 Mr. Hemsley read a paper at the British Association on Sussex Botany and in 1875 published an outline of the Flora of Sussex. Mr. Hemsley divided the County into 7 districts, corresponding to the drainage districts of the Western Rother, Arun, Adur, Cuckmere, East Rother, and Medway. It is important that this division should be adhered to. In 1887 the Rev. F. H. Arnold published a useful and concise "Flora of Sussex," to the enlargement and revision of such a work, this Section should direct its attention. A search should also be instituted for certain plants whose names stand on old records but which have not been seen for many years, such as *Œnanthe silaifolia, Caucalis daucoides* and the perhaps mythical *Frankenia pulverulenta.*

Some species again, seem on the verge of extinction, and other new ones obtaining a permanent footing. A comparison of the Flora of our own county with that of neighbouring ones will be of much interest. Of species in which Sussex is deficient, I may mention *Cerastium pumilum, Vicia gracilis, Polygala austriaca, Pinguicula lusitanica.*

There is much room for good work in the *Batrachium* section of *Ranunculus,* many forms of *Fumaria* need closer observation also Viola. My own first year's work in the genus *Rosa* resulted in the discovery of a fine one hardly known as British, various

other forms no doubt exist in the county, as little known. A correct list of our *Rubi* is a great desideratum. Finally, *Rumex, Salix* and Potamogeton need further observation.

There is still much to be done, new worlds, to conquer, even in this little space, and the work should be done quickly before many a rarity shall have entirely disappeared.

REPORT ON THE DATE OF FLOWERING OF PLANTS IN 1893 AND 1885,

DRAWN UP BY

MR. THOS. HILTON.

The Spring of this year having been the earliest and warmest known to the present generation, it may be of interest to Members of the Section to know the effect it has had on vegetation. I have, therefore, sent a list of the names of some of our common wild flowers with the time of their first recorded appearance. The dates are from the diary of Mr. H. Hemmings, of this town, who has kept a register for some years. Later on, through the extreme dryness, the contrast with ordinary seasons has not been so great. 1885 has been taken for comparison as representing a fair average year.

1893.			1885.	
Jan.	19	Hazel (Corylus Avellana-male)	Feb.	7
		Lesser Periwinkle (Vinca minor)	„	18
„	21	Primrose (Primula vulgaris)	„	24
„	26	Dog's Mercury (Mercurialis perennis) (male)	„	18
Feb.	5	Coltsfoot (Tussilago Farfara)	„	24
„	13	Lesser Celandine (Ranunculus Ficaria)	Mar.	4
„	24	Sweet Violet (Viola odorata)	„	4
March	2	Hairy Bitter-cress (Cardamine hirsuta)	„	4
		Hairy Violet (Viola hirta)	„	18
„	7	Anemone (Anemone nemorosa)	„	23
		Marsh Marigold (Caltha palustris)	April	3
„	8	Cuckoo-flower (Cardamine pratensis)	Mar.	12

1893.		1885.
March 10	Wood Violet (Viola Reichenbachiana)	Mar. 12
	Moschatel (Adoxa Moschatellina)	„ 23
	Ash (Fraxinus excelsior)	April 22
„ 11	Ground Ivy (Nepeta Glechoma)	Mar. 31
„ 20	Cowslip (Primula veris)	April 17
„ 22	Greater Stitchwort (Stellaria Holostea)	„ 14
„ 24	Blackthorn (Prunus spinosa)	„ 6
„ 30	Wood Crowfoot (Ranunculus auricomus)	„ 22
	Red Campion (Lychnis diurna)	„ 22
March 30	Wood Spurge (Euphorbia amygdaloides)	April 17
	Bluebell (Scilla nutans)	„ 22
„ 31	Ribwort Plantain (Plantago lanceolata)	„ 19
April 1	Buttercup (Ranunculus bulbosus)	May 2
„ 5	Garlic Mustard (Sisymbrium Alliaria)	April 22
	Broom (Cytisus scoparius)	May 2
	Germander Speedwell (Veronica Chamœdrys)	April 17
	Wayfaring Tree (Viburnum Lantana)	May 6
„ 7	Wood Sorrel (Oxalis Acetosella)	„ 8
	Wood Bitter Vetch (Lathyrus macrorrhizus)	„ 2
	Dove's-foot Cranesbill (Geranium molle)	April 20
	Yellow Dead-nettle (Galeobdolon luteum)	„ 17
„ 10	Early Purple Orchis (Orchis mascula)	„ 28
„ 11	Creeping Buttercup (Ranunculus ripens)	„ 27
„ 12	Meadow Buttercup (Ranunculus acris)	May 2
	Bird's-foot Trefoil (Lotus corniculatus)	„ 12
	Red Clover (Trifolium pratense)	„ 2
„ 14	Mouse-ear Hawkweed (Hieracium Pilosella)	„ 19
April 17	Hawthorn (Cratœgus Oxyacantha)	May 13
	Silverweed (Potentilla Anserina)	„ „
„ 19	White Campion (Lychnis alba)	„ 6
„ 21	Cuckoo-pint (Arum maculatum)	„ 15
„ 27	Greater Celandine (Chelidonium majus)	„ 19
	Bladder Campion (Silene Cucubalus)	June 5
	Rock-Rose (Helianthemum vulgare)	May 28
	Elder (Sambucus nigra)	June 3
	Goose-grass (Galium Aparine)	May 27
„ 29	Burnet Rose (Rosa spinosissima)	June 10
„ 30	Twayblade Orchis (Listera ovata)	May 28
May 4	Common Poppy (Papaver Rhœas)	„ 27
	Ox-eye (Chrysanthemum Leucanthemum)	June 5
	Black Bryony (Tamus communis)	„ 3

1893.			1885.	
May	4	Dog Rose (Rosa canina)	June	21
„	8	Bittersweet (Solanum Dulcamara)	„	7
„	12	Mallow (Malva sylvestris)	„	7
		Greater Knapweed (Centauria Scabiosa)	„	22
„	15	Meadow Sweet (Spirœa Ulmaria)	„	25
		Honeysuckle (Lonicera Periclymenum)	„	25
May	18	Spotted Orchis (Orchis maculata)	„	21
		Butterfly Orchis (Habenaria Chlorantha)	„	3
		Fly Orchis (Ophrys muscifera)	May	28
„	21	Spirœa Filipendula (Dropwort)	June	18
		Hedge Woundwort (Stachys sylvatica)	„	22
„	22	Wild Carrot (Daucus Carota)	„	25
„	29	Milfoil (Archillea Millefolium)	„	24
„	31	Water Plume Thistle (Cnicus palustris)	„	25
June	5	Rest Harrow (Ononis arvensis)	July	1
„	6	Bur-Reed (Sparganium Ramosum)	„	9
„	17	Traveller's joy (Clematis vitalba)	„	28
„	21	Great Hairy Willow Herb (Epilobium hirsutum)	„	12

METEOROLOGICAL SECTION.

The following tables, showing the temperature, wind, rainfall, sunshine, &c., at Brighton, have been drawn up by Dr. Arthur Newsholme (Medical Officer of Health for the Borough).

The chief facts as to the Meteorology of Brighton during the twelve months July, 1892-June, 1893, are set forth in Table I., and the same table gives the means of comparing these data with the mean results for the 14 years 1877-90.

Table II., contains a statement of the amount of bright sunshine in Brighton and Hastings respectively.

Table III., affording an interesting comparison between the meteorology of Crowborough and Brighton, has been compiled from the observations of Mr. C. Leeson Prince, whose admirable work in this direction, continued over a long series of years, is well known.

The Crowborough Observatory is 770 feet (Mr. Prince's determination) above sea level and distant about twenty-two miles from Brighton in a N.E. direction; the rain-gauge at Brighton is 32 feet above sea level.

The chief meteorological interest of the record centres in the exceptional drought prevailing from March to June inclusive. The rainfall in Brighton during these four months was 1·42 inches as contrasted with an average of 7·68 inches in the fourteen years, 1877-90. Rain fell on 20 days as contrasted with an average of 46 days in the same fourteen years.

The longest interval in which no rain fell was 30 days, viz: from the 17th March to the 15th April (inclusive of both days). The next longest interval was 28 days, from the 17th of April to the 14th of May. From June 7th to the 21st there was another interval of 15 days without rain. These three periods comprised 73 days out of the 122 days in the four months, March to June. On 29 additional days out of the 122 no rain fell.

TABLE I.

Month.		Temperature of Air during Month.				Mean Temperature of Air.	Mean degree of Humidity. Saturation = 100.	Wind.									Rainfall.	
		Highest.	Lowest.	Mean of				Number of days of									No. of days on which Rainfell.	Amount collected in inches.
				All Highest.	All Lowest.			N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm		
July,	1892 ...	74·0	47·5	66·1	53·9	60·0	83.	1	7	0	7	0	9	1	6	0	9	1·64
,,	1877-90 ...	...	...	67·3	55·0	60·5	73.	1·6	2·9	0·9	1·8	1·8	13·2	4·8	3·6	0·4	13	2·44
August,	1892 ...	76·6	45·8	68·4	55·2	61·8	80.	0	4	1	3	1	17	1	4	0	17	2·6
,,	1877-90 ...	...	...	67·3	55·6	61·2	75.	2·5	4·7	1·5	2·2	1·2	8·6	5·4	4·3	0·6	12	2·59
September,	1892 ...	68·2	38·2	64·0	51·7	57·8	83.	0	3	0	2	3	11	5	6	0	12	2·76
,,	1877-90 ...	...	...	63·6	51·4	57·3	79.	3·7	6·2	1·2	2·0	1·6	6·6	2·0	5·0	0·7	12	2·62
October,	1892 ...	59·8	29·5	53·7	42·6	48·1	86.	1	10	0	3	0	3	0	14	0	21	5·16
,,	1887-90 ...	...	...	57·0	45·2	51·0	78.	4·2	6·6	1·9	2·1	1·6	5·6	2·9	5·3	0·6	15	3·84
November,	1892 ...	57·2	35·2	51·7	44·8	48·2	91.	2	9	3	4	5	3	0	4	0	19	2·62
,,	1877-90 ...	...	...	50·1	41·0	45·5	86.	3·0	5·3	1-1	1·3	2·3	7·9	3·6	5.0	0·5	16	3·61
December,	1892 ...	52·4	23·0	42·9	35·1	39·0	90.	3	7	5	0	0	9	2	5	0	12	2·62
,,	1877-90 ...	...	...	45·4	36·5	40·0	83.	3·9	6·3	0·9	1·7	1·8	7·2	3·4	5·6	0·2	14	2·47
January,	1893 ...	50·8	20·4	40·7	32·9	36·8	90.	8	7	3	1	1	4	2	5	0	22	1·86
,,	1877-90 ...	...	...	43·7	34·8	39·3	86.	3·3	6·5	1·9	2·3	2·6	6·6	2·6	4·9	0·2	15	2·83
February,	1893 ...	52·2	33·4	46·9	39·6	43·2	91.	1	3	1	5	3	6	7	2	0	23	3·39
,,	1877-90 ...	...	...	45·1	37·7	40·9	81.	3·0	4·7	1·6	2·4	2·2	6·2	3·6	3·8	0·4	14	2·28
March,	1893 ...	59·8	27·6	53·5	39·7	46·6	79.	0	15	1	3	2	3	4	3	0	5	0·27
,,	1877-90 ...	...	...	48·0	35·6	41·7	81.	3·2	7·2	2·2	2·3	1·2	6·2	2·9	5·3	0·5	12	1·82
April,	1893 ...	75·4	28·0	63·2	44·8	54·0	70.	2	22	1	1	1	1	1	1	0	1	0·05
,,	1877-90 ...	...	...	52·7	40·5	46·8	81.	3·0	10 0	1·6	2·5	1·8	5·7	2·5	2·6	0·3	12	2·03
May,	1893 ...	71·6	41·6	64·5	49·5	57·0	75.	2	9	1	2	3	9	1	4	0	7	0·53
,,	1877-90 ...	...	...	59·3	46·0	52·4	73.	2·7	8·7	1·4	3·2	2·6	8.1	1·6	2·4	0·3	11	1·93
June,	1893 ...	85·0	40.0	69·5	53·2	61·3	84.	1	12	4	0	1	4	3	5	0	7	0·57
,,	1877-90 ...	...	...	65·6	52·5	58·8	72.	2·4	6·2	1·4	2·2	1·8	9·6	2·6	3·6	0·2	11	1·90
Entire Year ...	...	85·0	20·4	57·1	45·2	51·1	83.	21	108	20	31	20	70	27	59	0	155	24·07

TABLE II.

HOURS OF BRIGHT SUNSHINE.			SUNLESS DAYS, 1892-3.	
	Brighton.	Hastings.	Brighton.	Hastings.
July, 1892 ...	227·86	246·5	1	1
August... ...	191·64	205·3	1	1
September ...	137·60	142·0	1	2
October	108·33	122·0	6	7
November ...	50·08	47·7	14	13
December ...	60·22	71·6	12	14
January, 1893 ...	29·75	39·9	16	14
February ...	80·62	77·6	7	8
March	193·80	207·6	3	4
April	280·65	282·3	0	0
May	222·40	240·5	0	0
June	247·54	280·5	1	
	1830·49	1963·5	62	64
Corresponding Total for July 1891, to June 1892	1782·1	1849·5	54	55

The returns for Hastings are furnished by Dr. Colborne.

TABLE III.

Comparison of Meteorological Observations during 1892 in the Old Steine and at Crowborough. (The Crowborough figures are taken from the Meteorological Journal of Mr. C. Leeson Prince, F.R.Met.S., &c.)

Month.		Temperature of Air during Month.				Mean Temperature of Air.	Mean degree of Humidity Saturation = 100.	Wind. Number of Days of								Rainfall.	
		Highest.	Lowest.	Mean of All Highest.	Mean of All Lowest.			N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	No. of days on which Rain fell	Amount collected in inches.
January,	Brighton ...	51·4	20·2	42·2	32·9	37·5	96.	2	2	1	5	0	4	1	16	14	1·25
,,	Crowborough..	49·4	21·8	39·6	30·0	34·8	93.	3	2	2	4	1	3	12	4	14	1·31
February,	Brighton ...	51·5	21·0	44·7	35·9	40·3	91.	2	7	2	5	1	4	1	7	17	1·36
,,	Crowborough..	51·0	16·2	42·1	32·3	37·2	86.	4	4	3	1	2	7	3	5	18	1·77
March,	Brighton ...	58·0	23·5	45·0	32·9	38·9	76.	1	16	1	2	0	7	0	4	9	1·24
,,	Crowborough..	60·0	19·9	43·0	29·6	36·3	80.	3	12	6	1	2	4	1	2	12	1·65
April,	Brighton ...	69·2	28·4	59·2	39·2	49·2	80.	0	12	4	4	0	5	1	4	7	1·86
,,	Crowborough..	73·5	26·0	55·8	37·0	46·4	65.	2	12	2	0	2	5	5	2	10	1·42
May,	Brighton ...	72·8	30·5	60·5	46·4	53·4	76.	0	10	0	4	1	11	2	3	8	1·10
,,	Crowborough..	77·0	29·8	62·3	43·9	53·1	68.	1	9	0	0	6	11	2	2	7	1·47
June,	Brighton ...	75·2	41·5	63·6	51.5	57·5	71.	0	5	0	4	0	11	6	4	10	1·97
,,	Crowborough..	78·0	37·0	63·4	47·1	55·2	72.	3	5	1	0	2	11	4	4	15	2·99
July,	Brighton ...	74·0	47·5	66·1	53·9	60·0	83.	1	7	0	7	0	9	1	6	9	1·64
,,	Crowborough..	73·3	45·8	64·4	50·4	57·4	79.	6	8	1	2	4	7	2	1	13	2·30
August,	Brighton ...	76·6	45·8	68·4	55·2	61·8	80.	0	4	1	3	1	17	1	4	17	2·60
,,	Crowborough..	78·2	44·5	67·4	52·9	60·1	79.	3	1	0	2	2	14	7	2	14	4·63
September,	Brighton ...	68·2	38·2	64·0	51·7	57.8	83.	0	3	0	2	3	11	5	6	12	2·76
,,	Crowborough..	69·2	40·3	61·5	48·6	55·0	80.	3	1	0	0	3	12	6	5	13	2·82
October,	Brighton ...	59·8	29·5	53.7	42·6	48·1	86.	1	10	0	3	0	3	0	14	21	5·16
,,	Crowborough..	56·0	32·1	50·0	38·8	44·4	85.	1	10	1	3	1	9	2	4	20	6·19
November,	Brighton ...	57·2	35·2	51·7	44·8	48·2	91.	2	9	3	4	5	3	0	4	19	2·62
,,	Crowborough..	54·2	33·5	48·0	40·8	44·4	94.	1	4	2	6	6	6	4	1	15	3·66
December,	Brighton ...	52.4	23·0	42·9	35·1	39·0	90.	3	7	5	0	0	9	2	5	12	2·62
,,	Crowborough..	51·6	24·2	41·4	30·7	35·9	94.	2	9	2	4	0	8	0	6	12	2·97
Entire Year,	Brighton ...	76·6	20·2	55·1	43·5	49·3	83.	12	92	17	43	11	94	20	77	155	26·18
,,	Crowborough	78·2	16·2	53·2	40·0	46·6	81.	32	77	20	23	31	97	48	38	163	33·18

Brighton and Sussex Natural History and Philosophical Society.

TREASURER'S ACCOUNT FOR THE YEAR ENDING 14TH JUNE, 1893.

Dr.

	£	s.	d.
By Balance in the hands of Treasurer 8th, June, 1892	64	5	1
,, Annual Subscriptions and Arrears to 1st October, 1892 ...	6	10	0
,, Annual Subscriptions to 1st October, 1893 ...	67	10	0
,, Entrance Fees ...	8	0	0
,, Annual Subscriptions of Associates ...	0	5	0
,, Dividends on £100 2$\frac{3}{4}$ per cent. Consolidated Stock to April 5th, 1893, one year ...	2	15	0
	£149	5	1

Balance in hands of Treasurer 14th June, 1893 (at Messrs. Hall, Bevan, West, and Bevan's Bank)	£41	4	9
NOTE.—A sum of £100 is invested in £2 15s. per cent. Consolidated Stock in the names of the Treasurer and Honorary Secretaries as Trustees for the Society ...	100	0	0

Cr.

	£	s.	d.
To Books and Periodicals ...	14	14	4
,, Bookbinding ...	4	0	1
,, Printing Annual Report and Abstract of Proceedings ...	11	1	6
,, Printing and Stationery ...	14	8	10
,, Postages, &c. ...	10	17	1
,, Scientific Secretary, Honorarium in lieu of Salary for the past six years, voted by Council 4th July, 1892 ...	20	0	0
,, Ditto, Salary for the current year ...	10	0	0
,, Subscriptions to Societies ...	2	15	1
,, Assistant Secretary, Salary ...	2	2	0
,, Commission to Collectors for Subscriptions ...	3	1	6
,, Gratuities to Assistants at Museum ...	3	0	0
,, Expense of Annual Excursion ...	3	5	10
,, Alterations to Electric Lantern ...	1	5	0
,, Microscopical Slides ...	0	10	0
,, Expense of Meetings ...	4	19	1
,, Cost of Tea and Coffee at Meetings...	0	19	6
,, Fire Insurance Premium ...	0	18	0
,, Cheque Book ...	0	2	6
,, Balance in hands of Treasurer, 14th June, 1893 ...	41	4	9
	£149	5	1

NOTE.—Outstanding liability 5 vols. Challenger Exploration Reports ...	10	3	0

Examined with books and vouchers and found correct.
June, 1893.

F. G. CLARK, F.C.A., } *Honorary*
HENRY DAVEY, } *Auditors.*

After the Reports and Treasurer's Account had been read, it was proposed by Mr. SLINGSBY ROBERTS, seconded by Dr. HARRISON, and resolved—

"That the Report of the Council, the Librarian's Report, and Treasurer's Account now brought in be received, adopted, entered on the minutes, and printed for circulation as usual."

The Secretary reported that in pursuance of Rule 25 the Council had selected the following gentlemen to be Vice-Presidents of the Society for the ensuing year—

"Mr. G. D. Sawyer, Dr. J. Ewart, F.R.C.P., Mr. J. E. Haselwood, Rev. H. G. Day, Mr. G. de Paris, Mr. W. H. Rean, M.R.C.S., Dr. W. A. Hollis, F.R.C.P., Mr. W. S. Seymour Burrows, M.R.C.S., and Mr. D. E. Caush,"

And that in pursuance of Rule 42 the Council had appointed the following gentlemen to be Honorary Auditors—

"Mr. F. G. Clark, F.C.A., and Alderman H. Davey, J.P."

The Secretary also reported that the following gentlemen who had been elected Chairmen of Sections would, by virtue of their office under Rule 26, be members of the Council—

"*Photographic Section :* Mr. J. P. Slingsby Roberts ; *Microscopical Section :* Mr. E. J. Petitfourt, B.A., F.C.P. ; *Botanical Section :* Dr. W. J. Treutler."

It was proposed by Mr. S. COWELL, seconded by Mr. READ, and resolved—

"That the following gentlemen be officers of the Society for the ensuing year :—*President :* Dr. A. Newsholme, M.R.C.P. ; *Ordinary members of Council :* Mr. C. A. Wells, Mr. W. Harrison, D.M.D., Dr. W. J. Treutler, Mr. E. F. Salmon, Mr. J. Lewis, Mr. W. Clarkson Wallis ; *Honorary Treasurer :* Dr. E. McKellar ; *Honorary Librarian :* Mr. H. Davey, jun. ; *Honorary Curator :* Mr. B. Lomax, F.L.S. ; *Honorary Secretaries :* Mr. Edward Alloway Pankhurst, 12, Clifton Road ; Mr. J. Colbatch Clark, 64, Middle Street."

It was proposed by Mr. LEWIS, seconded by Mr. FOXALL, and resolved—

"That the sincere thanks of the Society be given to the Vice-Presidents, Council, Honorary Librarian, Honorary Treasurer, Honorary Auditors, Honorary Curator, and Honorary Secretaries for their services during the past year."

It was proposed by Mr. PETITFOURT, seconded by Mr. MITCHELL, and resolved—

"That the best thanks of the Society be given to Mr. D. E. Caush, now retiring from the office of President, for his attention to the interests of the Society during the past year."

SOCIETIES ASSOCIATED,

WITH WHICH THE SOCIETY EXCHANGES PUBLICATIONS,

And whose Presidents and Secretaries are *ex-officio* members of the Society :—

Barrow Naturalists' Field Club.
Belfast Naturalists' Field Club.
Belfast Natural History and Philosophical Society.
Boston Society of Natural Science (Mass., U.S.A.).
British and American Archæological Society, Rome.
Cardiff Naturalists' Society.
Chester Society of Natural Science.
Chichester and West Sussex Natural History Society.
Croydon Microscopical Society.
Department of the Interior, Washington, U.S.A.
Eastbourne Natural History Society.
Edinburgh Geological Society.
Epping Forest and County of Essex Naturalist Field Club.
Folkestone Natural History Society.
Geologists' Association.
Glasgow Natural History Society and Society of Field Naturalists.
Hampshire Field Club.
Huddersfield Naturalist Society.
Leeds Naturalist Club.
Lewes and East Sussex Natural History Society.
Maidstone and Mid-Kent Natural History Society.
North Staffordshire Naturalists' Field Club and Archæological Society.
Peabody Academy of Science, Salem, Mass, U.S.A.
Quekett Microscopial Club.
Royal Microscopial Society.
Royal Society.
Smithsonian Institute, Washington, U.S.A.
South London Microscopial and Natural History Club.
Société Belge de Microscopie, Bruxelles.
Tunbridge Wells Natural History and Antiquarian Society.
Watford Natural History Society.
Yorkshire Philosophical Society.

LIST OF MEMBERS

OF THE

Brighton and Sussex Natural History and Philosophical Society.

1893.

N.B.—Members are particularly requested to notify any change of address at once to Mr. J. C. Clark, 64, Middle Street, Brighton.

ORDINARY MEMBERS

Abbey, Henry, Fair Lee Villa, Kemp Town.
Andrews, W. W., 10, Springfield Road, Preston.

Brown J. H., 6, Cambridge Road, Hove.
Badcock, Lewis C., M.D., M.R.C.S., 10, Buckingham Place, Brighton.
Boxall, W. Percival, J.P., Belle Vue Hall, Kemp Town.
Balean, H., 15, Alexandra Villas, Brighton.
Booth, E., 70, East Street, Brighton.
Baber, E. C., M.B., L.R.C.P., 97, Western Road, Brighton.
Burrows, W. Seymour, B.A., M.R.C.S., 62, Old Steine, Brighton.
Billing, T., 86, King's Road, Brighton.
Barwell, G. E., 32, St. George's Road, Brighton.
Bedford, E. J., Mnnicipal School of Science and Art, Grand Parade, Brighton.
Bevan, Bertrand, Withdean, Preston.
Breed, E. A. T., 41, Grand Parade, Brighton.
Brown, G. D., 54, Brunwick Places, Hove.

Clark, John Colbatch, 64, Middle Street, Brighton.
Cox, A. H., J.P., 35, Wellington Road, Brighton.
Caush, D. E., 63, Grand Parade, Brighton.
Coningham, W. J. C., 6, Lewes Crescent, Kemp Town.
Clark, F. G., 56, Ship Street, Brighton.
Cowell, Samuel, 143, North Street, Brighton.
Couchman, J. E., Down House, Hurstpierpoint.

Dennant, John, 1, Sillwood Road, Brighton.
Davey, Henry, J.P., 82, Grand Parade, Brighton.
Dennet, C. F., Hawthorndene, Rattenhall, Worcester.
Day, Rev. H. G., M.A., 55, Denmark Villas, West Brighton.

Denman, Samuel, 26, Queen's Road, Brighton.
Dodd, A. H., L.R.C.P., M.R.C.S., 14, Goldstone Villas, Hove.
Davey, Henry, Junr., 8, Norfolk Road, Brighton.
Davis, Harry, 74, High Street, Brighton.

Edmonds, H., B.Sc., Mount Caburn, Ditchling Road, Brighton.
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Earp, F., 87, Upper Rock Gardens, Brighton.
Elgee, E., Mountjoy, Preston Road, Brighton.

Friend, D. B., 35, Ditchling Road, Brighton.
Fletcher, W. H. B., Fair Lawn House, Worthing.
Fowler, H., 18, Goldsmid Road, Brighton.
Foxall, G., Woodlands, Port Hall Road, Brighton.
Friend, S. B., 35, Ditchling Road, Brighton.

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Grove, Edmund, Norlington, Preston.
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Hurst, H., Ship Street, Brighton.
Hobbs, James, 62, North Street, Brighton.
Hack, D., Fir Croft, Withdean, Brighton.
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Howlett, J. W., 4, Brunswick Place, Hove.
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Harding, N., Wynnstay, Stanford Avenue, Preston.
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Histed, E., 2 and 3, Upper St. James's Street, Brighton.
Hilton, Thomas, 16, Kensington Place, Brighton.

Infield, H. J., 130, North Street, Brighton.
Isaac, T. W. Player, 114, Marine Parade, Brighton.

Jacomb, Wykeham, 72, Dyke Road, Brighton.
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Lewis, J., 37, Preston Road, Brighton.

Merrifield, F., 24, Vernon Terrace, Brighton.
Mitchell, W. W. 66, Preston Road, Brighton.
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WINTER, J. N., M.R.C.S., 28, Montpelier Road, Brighton.
WALLIS, MARRIAGE, Springfield, Preston.
WOOD, J., 21, Old Steine, Brighton.
WILLIAMS, H. M., LL.B., 17, Middle Street, Brighton.
WALLIS, W. C., 15, Market Street, Brighton.
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WALTER, JOHN, 13A, Dyke Road, Brighton.
WHITTLE, E. G., M.D., F.R.C.S., 9, Regency Square, Brighton.
WELLS, C. A., 1, High Street, Lewes.
WELLS, ISAAC, 4, North Street, Brighton.
WOODRUFF, G. B., 24, Second Avenue, Hove.
WHYTOCK, E., 36, Western Road, Hove.
WARING, F. J. A., M.D., 8, Eaton Road, Hove.
WEBLING, A. H. Hildrop, Hove Park Villas, Hove.
WILLIAMSON, J., 144, Church Road, Hove.

Weston, S. J., 24, Church Road, Hove.
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Wynne, E. T., 7, Rochester Gardens, Hove.
Walker, Rev. F., 121, Victoria Terrace, Littlehampton.
Williams, A. Stanley, 17, Middle Street, Brighton.

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Caush, Mrs., 63, Grand Parade, Brighton.
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Rich, Miss, 34, Sussex Square, Brighton.
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Treutler, Mrs., 8, Goldstone Villas, Hove.
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Wood, Mrs. J., 21, Old Steine, Brighton.

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Jenner, J. H. A., East Street, Lewes.
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Nourse, W. E. C., Bouverie House, Mt. Radford, Exeter.
Phillips, Barclay, 7, Harpur Place, Bedford.
Prince, C. L., The Observatory, Crowborough, Sussex.

ASSOCIATES.

Brown, Chas., 63, Grand Parade.
Simpson, Grahame, 63, Grand Parade.

2